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*TRUTH AND ERROR.**

"IF to do were as easy as to know what were good to do, chapels had been churches, and poor men's cottages princes' palaces. It is a good divine that follows his own instruction. I can easier teach twenty what were good to be done than be one of the twenty to follow mine own teaching."

"Science," says Powell, "deals with realities. These are bodies and their properties. Known realities are those about which mankind have knowledge; scientific research is the endeavor to increase knowledge, and its methods are experience, observation and verification."

While most men of science admit all this as good precept, history warns them that they must be on their guard, lest they fall unknowingly into the dream-land of the 'philosophers;' for our author tells us that "The dream of intellectual intoxication seems to some to be more real and more worthy of the human mind than the simple truths discovered by science."

While rebuking the metaphysicians, our author does not spare those men of science who assert that while science deals with the *properties* of matter the real nature of matter—what it is in itself—is quite unknown: "As though its properties did not constitute its essential nature."

"Would a sane person," he asks, "speak

* By J. W. Powell. Chicago, The Open Court Publishing Co., 1898.

of the horse and head, the horse and body, the horse and legs, the horse and tail, and then consider the horse as one thing, the head, body, legs and tail as other things? Yet this is the error of those who consider matter as one thing and properties as other things."

"As it is of matter, so it is of space: One man sees the disc of the moon when it is riding high as having the size of the top of a teacup, another as large as a cartwheel. But the moon will be seen larger than a barn if it is seen behind a distant barn, or it may seem to be as large as a great mountain when it rises behind such a mountain. As the moon rides the heavens it seems to be this side of the surface of the sky, although we know that there is no such surface. Such habitual judgments of space and time seem to contradict each other. By a natural process of fallacious judgment the idea of space as void is developed as an existing thing or body. This is the ghost of space—the creation of an entity out of nothing. The space of which we speak is occupied. We can by no possibility consider true space or void as a term of reality. If we reason about it mathematically, and call it x, the meaning of x in the equation is finally resolved by expressing it in terms of body as they are represented by surface. This non-space has no number; it is not one or many in one—it is nothing. It is not extension as figure or structure—it is nothing. The fallacy concerning space is born of careless reasoning. No harm is done by this popular misconception of space until we use it in reasoning as a term of reality; then the attributes of space may be anything because they are nothing."

"The universe is a concourse of related factors composed of related particles. A relation cannot exist independent of terms We may consider a relation abstractly, but it cannot exist abstractly. To affirm a relation the terms must be implied. When an abstract is reified, that is supposed to exist by itself independent of other essentials, and the illusion is entertained that there is something independent of the essentials which supports them, a mythology is created so subtle as to simulate reality. So when relations are reified and supposed to exist independent of terms the mind is astray in the realm of fallacies."

All this seems to me to be so important and significant that it cannot be said too often, for it is all so essential to clear thinking upon the significance of science that I believe the author has done good service in repeating it, although it was all said long ago in still simpler and clearer words.

Berkeley tells us that "what seems to have had a chief part in rendering speculation intricate and perplexed, and to have occasioned innumerable errors and difficulties in almost all parts of knowledge, is the opinion that the mind hath a power of framing *abstract ideas* or notions of things. He who is not a perfect stranger to the writings and disputes of the philosophers most needs acknowledge that no small part of them are spent about abstract ideas. These are in a more especial manner thought to be the object of those exercises which go by the name of Logic and Metaphysics, and of all that which passes under the notion of the most abstract and sublime learning. Whether others have this wonderful faculty of abstracting their ideas they can best tell; as for myself I dare be confident I have it not." ('Human Knowledge,' Introduction, 6–10.)

"I am tempted to think nobody else can form these ideas any more than I can. Pray, Alciphron, which are those things you would call absolutely impossible?"

"Such as include a contradiction."

"Can you form an idea of what includes a contradiction?"

"I can not."

"Consequently, whatever is absolutely impossible you cannot form an idea of?"

"This I grant."

"But can a color or a triangle, such as you describe these abstract general ideas, really exist?"

"It is absolutely impossible such things exist in nature."

"Should it not follow, then, that they can not exist in your mind, or, in other words, that you cannot conceive or frame an idea of them? I do not perceive that I can, by any faculty, whether intellect or imagination, conceive or form an idea of that which is impossible and includes a contradiction." (Alciphron VII., 6.)

"I am of a vulgar cast, simple enough to believe my senses and to leave things as I find them. To be plain, it is my opinion that the real things are the very things I see and feel and perceive by my senses. These I know and, finding they answer all the necessities and purposes of life, have no reason to be solicitous about any other unknown beings. A piece of sensible bread, for instance, would stay my stomach better than ten thousand times as much of that insensible, unintelligible real bread you speak of. It is likewise my opinion that colors and other sensible qualities are in the objects. I cannot, for my life, help thinking that snow is white and fire hot. Away, then, with all that skepticism, all those ridiculous philosophical doubts. I might as well doubt my own being as the being of those things I actually see and feel." (Three Dialogues, III.)

While we are unable to doubt the being of those things we see and feel, we do continually doubt or question the evidence of our senses, for error and illusion and hallucination are, unfortunately, as real as truth; and the part of Powell's book which deals with illusions is that which the reader will find most attractive and suggestive.

"When a youth, as I was breaking prairie with an ox team, my labor was interrupted by a rattlesnake, and, during the day, I saw and killed several of these serpents. At one time the lash of my whip flew off. In trying to pick it up I grasped a stick. The fear of being bitten by a snake, and the degree of expectant attention to which I was wrought, caused me to interpret the sense impression of touch as caused by a rattlesnake. At the same time I distinctly heard the rattle of the snake."

"A soldier in the suspense which precedes the battle, when sharpshooters are now and then picking off a man, may have his gun or his clothing touched by a rifle ball and in the suspense of the occasion may imagine that he has received a serious, perhaps a deadly wound, and may shriek with pain. A mustard plaster on the head may cause a man to dream of an Indian conflict in which he is scalped, as I have observed."

All savages believe that hallucinations are a means of divination, and, as many intoxicants produce hallucinations, all of the North American tribes make use of these, supplemented with many rites, such as dancing, singing, ululation, the beating of drums, and the tormenting of the body by various painful operations, all designed to produce ecstatic states and the consequent hallucinations.

If the Society for Psychical Research were to make a census of those who believe that hallucinations often reveal the unknown past or future, Powell tells us that they would find among the North American Indians one hundred per cent. ready to testify to the truth of this opinion.

Erroneous judgments once made may be repeated in perpetuating fallacies, and myths are invented to explain them. Then the myths become sacred, and the moral nature is enlisted in their defense.

"The stars were seen to move along the firmament, or the surface of a solid, from

east to west, as men run along the surface of the earth at will. But the heavenly bodies move by constantly repeated paths, and so primitive man invents myths to explain these repeated paths."

"Fallacies are," as our author clearly points out, "erroneous inferences in relation to things known. If there were no realities about which inferences are made, fallacies would not be possible. The history of science is the discovery of the simple and the true; in its progress fallacies are dispelled and certitude remains."

These extracts from Powell's book will show how much that is valuable and suggestive and instructive is to be found in it. I regret that I am forced to form a very different estimate of the constructive part of the book, for, as the author expounds his own system of philosophy, he seems to me to be one of those ungracious pastors who, while pointing out to others the steep and thorny way, themselves the primrose path of dalliance tread, and reck not their own read.

The book begins with a delightful and instructive anecdote of a party of Indians throwing stones across a cañon. The distance from the brink to the opposite wall did not seem very great, yet no man could throw a stone across the chasm, though Chuar, the Indian Chief, could strike the opposite wall very near its brink. The stones thrown by others fell into the depths of the cañon. "I discussed these feats with Chuar, leading him to an explanation of gravity. Now Chuar believed that he could throw a stone much farther along the level of the plateau than over the cañon. His first illusion was thus one very common among mountain travelers—an underestimate of the distance of towering and massive rocks when the eye has no intervening object to divide space into parts as measure of the whole."

"I did not venture," says our author, "to correct Chuar's judgment, but simply sought to discuss his method of reasoning."

He explained that the stone could not go far over the cañon, because the empty space pulled it down, and, interpreting subjective fear of falling as an objective pull, he pointed out how strongly the empty void pulls upon the man who stands on the brink of a lofty cliff.

"Now, in the language of Chuar's people, a wise man is said to be a traveler, for such is the metaphor by which they express great wisdom, as they suppose that a man must learn by journeying much. So in the moonlight of the last evening's sojourn in the camp on the brink of the cañon, I told Chuar that he was a great traveler, and that I knew of two other great travelers among the seers of the East, one by the name of Hegel, and another by the name of Spencer, and that I should ever remember these three wise men, who spoke like words of wisdom, for it passed through my mind that all three of these philosophers had reified void and founded a philosophy thereon."

The system of philosophy which it is the aim of this book to expound is, so far as I can gather it from a single reading, about as follows:

"It was more than chance," our author tells us, "that produced the decimal system, for the universe is pentalogic, as all of the fundamental series discovered in nature are pentalogic by reason of the five concomitant properties. The origin of the decimal system was the recognition by primitive man of the reciprocal pentalogic system involved in the two hands of the human body." P. 112.

"Thus, in geonomy, p. 43, we deal with an earth composed of five encapsulated globes enclosing a nucleus, and presenting: (1) the centrosphere, (2) the lithosphere, (3) the hydrosphere, (4) the atmosphere, (5) the etherosphere."

"In the human mind, again, we have the

five psychic faculties: (1) sensation, (2) perception, (3) apprehension, (4) reflection and (5) ideation." P. 418.

"These five psychic faculties arise in the mind through the cognition of the five properties of the ultimate particles of matter. Every body, whether it be a stellar system or an atom of hydrogen, has certain fundamental characteristics found in all. These are number, space, motion, time (p. 13), and (p. 14) the fifth property here called judgment."

"All particles of plants, soils and stars have judgment as consciousness and choice; but having no organization for the psychical functions, they have not recollection or inference; they, therefore, do not have intellections or emotions. Only animal beings have these psychical functions. Molecules, stars, stones and plants do not think; that which we have attributed to them as consciousness and choice is only the judgment of particles, but it is the ground, the foundation, the substrate of that which appears in animals when they are organized for conception." P. 413.

"These things are necessary to a primitive judgment: First, a sense impression; second, a consciousness of that impression; third, a desire to know its cause; fourth, a choice of a cause; fifth, a consciousness of the concept of that cause; sixth, a comparison of one conscious term with the other; and seventh, a judgment of likeness or of unlikeness."

For all I know, that which chemists call affinity may be the 'choice of particles to associate in bodies.' All the chemist tells us of the matter is that the word 'affinity' is a sign or symbol to generalize his observations and experiments, and it is clear that this is no reason why he who finds reason to do so may not regard it as evidence of consciousness and choice. The question the chemist is likely to ask is whether Major Powell can so play on the emotions of an atom of hydrogen as to persuade it to do anything which we have not every reason to expect in course of nature. If he cannot do this his hypothesis is worthless, not because we can disprove it, but because we find no evidence of its truth and no value in its practical application. In fact, it seems to me to be one of the 'reified voids' of which he has warned us.

"The Utes say that the Sun could once go where he pleased, but when he came near the people he burned them. Tevots, the Rabbit-god, fought with the Sun and compelled him to travel by an appointed path along the surface of the sky, so that there might be night and day."

Truly, "It is a good divine that follows his own instruction. If to do were as easy as to know what were good to do, chapels had been churches, and poor men's cottages princes' palaces. I can easier teach twenty what were good to be done than be one of the twenty to follow mine own teaching."

Powell tells us that he has been robbed of his 'beautiful world' by Bishop Berkeley, but his attempt to neutralize the evils of 'idealism' by a new philosophy seems to me to be anything but a happy one, for the application of his own principles to his system of philosophy seems to carry idealism to dizzy heights where even Berkeley never dared to soar.

If every particle of matter has conscious judgment of number, space, motion and time, as he tells us that it has, what becomes of these concomitant properties? Why may not an ultimate particle assert that, while it cannot doubt the reality of the number, space, motion and time of which it is conscious, belief in these properties, as distinct from the judgment of particles, 'reifies a void' and carries us into the realm of 'ghosts,' since the essence of these properties is to be perceived or known, in-

asmuch as every particle knows them, and it is only as known that they exist.

According to our author's own principles and assumptions, space or time, or number or motion, which are not the consciousness of particles are but the ghosts of judgment, the creation of entities out of nothing, for if he is right the *esse* of these properties must be *percipi*.

It must not be inferred that I am myself an idealist, for nothing could be farther from the truth. I seek to be neither an idealist nor a materialist, nor a realist nor a monist, but a naturalist, believing that it will be time to have an opinion as to the relation between mind and matter after we have found out.

For all I know to the contrary, Powell may be right, and every particle of matter may have judgment as consciousness and choice; but the test of truth is evidence, and not the absence of disproof, and belief in the judgment of particles does not concern me.

Our author's belief that all mind is matter in motion, and all matter in motion mind, or, at least, the raw material of mind, is not new. In fact, it seems to be the most characteristic 'philosophy' of our day.

"All systems of philosophy are vanity," say the students of science; but to Sam Weller's question: "What is your particular vanity?" they all, with one accord, begin to cry 'Monism!'

If I seem to some to have devoted more space to this new book on 'philosophy' than it deserves; if I sit patiently among the audience, listening attentively as the philosophers play out their little plays; it is because of my hope that they may destroy each other like Kilkenny cats before the curtain drops, and that, in the last act, they who are no philosophers, but simple honest folks, may come by their own and live at ease.

Because of this hope I study the philosophers as well as I can that I may be the better able to do my part in bringing the desired end about.

W. K. Brooks.

Johns Hopkins University.

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*TRUTH AND ERROR.**

Whatever else may be thought or said, all will probably agree that this is a unique and remarkable book. It is intensely original. The author is omniscient and discusses the universe. He treats, like Scaliger of old, *de omni re scibili et quibusdam aliis*. As a specimen of what Kant called 'architectonic symmetry' it probably has never been excelled. It is essentially a philosophic or scientific terminology, but all the terms are new, for even where old terms are used they are invariably given new meanings. The whole book is, therefore, like a foreign language, and the reader's first task is to learn the language. Everything that has been said or done by man is rejected as unsatisfactory and the temple of philosophy is entirely rebuilt out of new bricks cast in new molds. The friction thus caused in reading the book will, therefore, probably deter many from making so great an effort, and one of the objects of a sympathetic treatment should be to point out that the effort will be repaid.

Notwithstanding, however, this 'architectonic symmetry,' the reader has a right justly to complain that his path has not been made as easy as it might have been. The terms are generally defined, it is true, but the definitions are scattered through the text and have to be hunted up many times, as they cannot be remembered on once reading. They should have been all collected together in one place and arranged in alphabetical order as a complete glossary.

* Truth and Error, or the Science of Intellection. By J. W. Powell. Chicago, The Open Court Publishing Company.

As it is, even the index is absolutely worthless. But this is not the worst fault of method. The terms are all interrelated and these interrelations are set forth in divers ways and places in the text, but there are no tabular exhibits of the relations, no graphic or diagrammatic representations. The reader is compelled to carry in his mind all these never-before-heard-of correlations among ideas expressed in wholly unaccustomed language. Whether the author wrote his book from such a condensed scheme or not, he should have drawn it up for the use of others who have never dreamed of these things before. There are indications, however, that he worked entirely from a system evolved in his own mind, and certain passages show that he would have written it better if he had first worked it out in schedules, tables and diagrams.

It is, of course, no part of our duty to undertake the task of tabulating the contents of a book, and few would probably be capable of doing this in the present case, but some attempt or stagger at this seems to be the only way of condensing the enormous mass of matter that the book contains into the compass of a reasonable summary. All the manifold terms employed stand for principles, laws, relations, facts, or phenomena, and these are of widely different character, making it very difficult to find any one term that will embrace them all. For want of a better one, and because little used by the author, let us call them all *principles*. In the second place, all these different kinds of principles are arranged in series, or groups, or classes, each series, group, or class being distinct from any other. In the third place, each series, group or class consists of exactly five terms, standing for five principles, which have a definite and invariable order in the series. The universe is found to be quinary, or, as he calls it, *pentalogic*. Each principle in any series is related to the ones standing before and after it, but if it has any relation to those of other series it must be to those occupying the same place in the series, and not to any others. There are, therefore, vertical and horizontal relationships, but there can be no diagonal or oblique ones.

There are, at least, twenty of these pentalogic series, each of five terms, which alone would raise the number of terms to one hundred, but there are, of course, many other terms employed in defining and discussing these primary ones. The author nowhere tells us the order in which the numerous pentalogic series should stand, and every one must arrange them as seems most logical. The following attempt in this direction makes no claim to infallibility.

I. It seems clear that the first series must be that which relates to the constitution of matter. The five principles here involved are what he calls the *constituents* of matter, but which he quite as frequently denominates *concomitants*, because, as he explains, they always go together and cannot be separated. These five constituents are: (1) number; (2) space; (3) motion; (4) time; (5) judgment.

II. Without stopping to discuss the first series we may pass to another, the terms of which are correlated, *i. e.*, horizontally related, to the first. It embraces what he calls *essentials* or manifestations, and which, he says, are absolute. They are: (1) unity; (2) extension; (3) speed; (4) persistence; (5) consciousness.

III. Corresponding to these five essentials, which are absolute, there are five *variables*, which are relative, and stand as follows: (1) plurality; (2) position; (3) path; (4) change; (5) choice.

IV. Next in order seem to come what he calls the five *categories*, to which everything in the universe must be referred. These are: (1) kinds; (2) forms; (3) forces; (4) causations; (5) concepts. They also corre-

spond to the five constituents, the five essentials, and the five variables, number by number.

V. Thus far the order of the series seems tolerably clear, but from this point on there may be room for difference. We will regard as the next and fifth series what he calls *particles*, and, without apologizing for the word, proceed to enumerate them as follows: (1) ethereal; (2) stellar; (3) terrestrial (geonomic); (4) vegetal; (5) animal.

VI. He has also a series of what he calls *natural bodies*, which are not precisely parallel with the series of particles. These are: (1) celestial; (2) terrestrial; (3) vegetal; (4) animal; (5) social. The first term here corresponds to the second in the last series, and so on through to the last term, which is not represented in series V.

VII. To the five particles (series V) there are five corresponding *states*, as follows: (1) ethereal; (2) fluid; (3) solid; (4) vital; (5) motile.

VIII. Several series could probably be worked out, representing principles inhering in ethereal, stellar and terrestrial particles, but to find clear statements of them in the book would be a difficult task. The author was anxious to reach the higher, psychological aspects of the subject, and hastened to deal with animal particles. In these he finds five processes, or operations, which he calls *animal principles*. These are: (1) metabolism; (2) reconstruction; (3) motility; (4) reproduction; (5) conception.

IX. These might have been called functions, and for carrying them on there are five corresponding *systems of organs*, as follows: (1) digestive; (2) circulatory; (3) motor; (4) generative; (5) cogitative (not his word).

X. Adhering to the psychic elements, the five *senses* may be next considered. These vary slightly from the traditional five senses in very properly grouping taste and smell together as one and recognizing the muscular sense: (1) taste and smell; (2) touch; (3) the muscular sense; (4) hearing; (5) sight.

XI. Parallel to these are the five *modes of appeal to the senses*, the senses representing subjective states, modes of appeal objective properties: (1) savors; (2) odors; (3) pressures; (4) sounds; (5) colors.

XII. Major Powell distinguishes between sensations and feelings. The former term he confines to the subjective states residing in the end organs of sense (of course referred to the brain), while the other he restricts to internal states, such as most psychologists recognize as emotional states in a broad sense. Without stopping to show that such a classification is illogical, we may enumerate here what he calls *feeling impressions*, of which there are, of course, exactly five. Expressed adjectively, they are: (1) metabolic; (2) circulatory; (3) motor; (4) reproductive; (5) cognitional. The reader cannot fail to note the close resemblance of these terms to those describing the five systems of animal organs.

XIII. The twelve series of principles thus far enumerated, though falling far short of the whole number that a closer analysis of the book would probably reveal, only bring us up abreast of the subject of mind in its intellectual manifestation, *i. e.*, intellection. The first series to be considered here is that of the *faculties*. Of these there are also five, viz.: (1) sensation; (2) perception; (3) apprehension; (4) reflection; (5) ideation.

XIV. Each faculty probably has five elements or factors, but only three of them seem to be treated from this point of view. In harmony with the fifth and last primary constituent of matter, judgment, all operations of the mind, including sensations, are judgments, and the five *elements of a judgment of sensation* are: (1) choice of a past concept; (2) the consciousness of this

choice; (3) the choice of another concept; (4) a consciousness of this; (5) the comparison of the one with the other.

XV. The five *elements of a judgment of perception*, which he says are the same as for apprehension, are these: (1) consciousness of a concept; (2) choice or recollection of another concept; (3) consciousness of the second concept; (4) comparison of the two concepts; (5) the final judgment.

XVI. In addition to these there are enumerated the five *elements of a judgment* proper (for he does not always use the word judgment in the same sense). They are: (1) consciousness of a sense impression; (2) desire to know its cause; (3) guess or choice as to its cause, reviving the consciousness of the concept of the object chosen; (4) comparison of this second consciousness with the first; (5) judgment of the likeness or unlikeness of the terms compared.

Sixteen cosmic series have now been enumerated, each consisting of five principles expressed by five terms or phrases, the whole forming a kind of diapason rising from the primary constituents of matter and culminating in an act of mind, or intellection. These sixteen series may now, for clearer comprehension, be re-enumerated without the pentalogic terms:

1. Constituents of matter.
2. Essentials or manifestations (absolute).
3. Variables (relative).
4. Categories.
5. Particles.
6. Natural bodies.
7. States of the natural bodies.
8. Animal principles.
9. Systems of organs.
10. Senses.
11. Modes of appeal to the senses.
12. Feeling impressions.
13. Faculties.
14. Elements of a judgment of sensation.
15. " " " " perception.
16. " " " " intellection.

As already remarked, there are many interrelations among the series, and it may be next inquired what are some of the most important of these. All after the first are connected in one way or another with that as the basis of the entire system, but the exact hierarchical dependence of the several series is not worked out. The constituents of matter—number, space, motion, time, and judgment—all belong to everything and are always concomitant in the sense that nothing can lack any of them and have existence. [This is many times repeated, and yet there are passages, as near the bottom of page 13, from which it may be inferred that judgment only inheres in animate bodies.] The essentials, however—unity, extension, speed, persistence, and consciousness—are simply the manifestations of things and constitute the *substrates* of the next series, viz., the variables—plurality, position, path, change and choice. That is, unity is the substrate of plurality, extension is the substrate of position, and so on through the series.

The categories, or classific properties—kinds, forms, forces, causations, and concepts—also correspond, term for term, with the constituents, and several attempts are made to show their interrelations with the other series, but these can best be discussed a little later. The five species of particles—ethereal, stellar, terrestrial, vegetal and animal—are arranged in an ascending series, such that each term after the first contains all that is contained in the preceding term and something in addition, a *differentia* of its own. This differentia in every case is related to the corresponding term of the primary series, *i. e.*, the constituents. Particles are organized, and each class is more highly organized than the preceding class in that the next higher constituent is embraced in the organization. In ethereal particles, which, he says, are probably ultimate, numbers alone are organized. In the stars numbers and spaces are organized.

In geonomic bodies numbers, spaces, and motions are organized. In plants numbers, spaces, motions, and times are organized. In animals numbers, spaces, motions, times, and judgments are organized. All this seems to a layman to contradict the definition of the five constituents as necessary concomitants of one another, which would predicate them all even of the first term, or ethereal particles, but the author could probably explain the apparent discrepancy. He has not done so in his book.

He sometimes distinguishes between particles and bodies, and when he does so the bodies are composed of particles, but in his discussion of the natural bodies he expressly excludes the first term of the series of particles, the ethereal, and begins with the second, giving us celestial, terrestrial, vegetal, animal, and social bodies, this last being added apparently to make the necessary five. These bodies are what he calls 'incorporated,' and the order of the terms is an ascending order in the mode or degree of incorporation. This depends upon the character of the respective particles. The terms used describe this as follows:

1. Celestial bodies have molecular particles.
2. Terrestrial bodies have petrologic particles.
3. Vegetal bodies have inorganic particles.
4. Animal bodies have vegetal particles.
5. Social bodies have ideal particles.

He does not use these words in all cases and his terminology is here mixed and more or less confusing, but the above seems to be a fair statement of his meaning.

If we continue to neglect the first class, ethereal bodies, and to begin with the second, celestial bodies, the corresponding states will be: (1) fluid; (2) solid; (3) vital; (4) motile; (5) social. Major Powel, never uses the word *social* nor the word *collective*, although he clearly understands this stage of development. His classification of the sciences, or scientific hierarchy, is as follows: (1) etheronomy; (2) astronomy; (3) geonomy; (4) phytonomy; (5) zoonomy; (6) demonomy.* Why he did not reduce this to five by combining phytonomy and zoonomy under the term *bionomy* (since from the standpoint of biology there is no distinction between them) is rather surprising, but explainable. We are here concerned only with the last term, *demonomy*, which he prefers to socionomy, and throughout expresses the conception of collectivity by derivatives from the Greek word δῆμος, using the adjective *demotic*, and even extending it to animal societies, colonies, etc., to which it obviously does not apply.

Passing over the animal principles, or functions, and their respective organs, whose bare enumeration above must suffice, we come to the *senses*. Here it is important to point out that the senses are simply the organs of the categories in their numerical order, thus:

1. Taste (including smell) is the organ of kind.
2. Touch is the organ of form.
3. The muscular sense is the organ of force.
4. Hearing is the organ of causation.
5. Sight is the organ of conception.

Major Powell does not say quite all of this in terms, but it can be safely inferred from the discussion on page 279.

When we come to the *faculties* we have another example of architectonic symmetry. We perceive that the faculties are simply cognitions of the categories, term for term:

1. Sensation is cognition of kind.
2. Perception is cognition of form.
3. Apprehension is cognition of force.
4. Reflection is cognition of causation.
5. Ideation is cognition of conception.

The special treatment of the cosmic series need not be carried farther, but it is of interest to note a few of the more general correlations that may be, with sufficient pains and effort, worked out of different

*Compare the proposed classification given in the *American Journal of Sociology* for July, 1896, Vol. II., p. 82.

passages in the book. In the chapter on Intellections, after all the faculties have been dealt with, the author makes a number of wide sweeps across the whole field to show the numerous and complicated associations that arise among the various series. No tabular exhibits are offered, and the reader is asked to carry in his mind all that has gone before and to put things together for himself. There are many gaps in the terminology which he must supply, and several new series come out that appear not to have been dealt with before. A careful digest of this chapter, and especially of the matter on pages 302 and 303, seem to justify the following table of correlations. The five points of view are: (1) classification; (2) morphology; (3) dynamics; (4) evolution; (5) intellection. If by morphology he means about the same as *homology*, these correspond to five of his chapters, viz., Chapters IX, X, XI, XIII and XVIII. The pentalogies are as follows:

	Associations considered in	I. *Essentials.*	II. *Constituents.*	III. *Categories.*	IV. *Processes.*	V. *Products.*
1.	Classification:	Units.	Numbers.	Kinds.	Series.	Classes.
2.	Morphology:	Extensions.	Spaces.	Forms	Metamorphoses.	Organisms.
3.	Dynamics:	Speeds.	Motions.	Forces.	Energies or Powers.	Cooperations.
4.	Evolution:	Persistences.	Times.	Causations.	Metageneses.	Developments.
5.	Intellection:	Sensations.	Perceptions.	Apprehensions,	Reflections.	Ideations.

It will be perceived that the first three of these columns of associations correspond to series 2, 1 and 3, respectively, viz., essentials, constituents, and categories, except the fifth and last term in each case, where sensation is substituted for consciousness, perception for judgment, and apprehensions for concepts. It will be further observed that the five associations considered in intellection are neither more nor less than the five faculties of intellection. We have, however, in this presentation, two series of principles that have not been previously considered among the pentalogic properties. These are seen in the two last columns. Some of the terms have been dealt with in previous chapters. The last terms of these series are the two highest faculties, reflection and ideation. Metamorphosis and metagenesis are treated in Chapter V as processes or properties of geonomic bodies, along with other apparently coordinate processes, such as *metalogisis* (an etymologically impossible word) and *metaphysisis* (for which *metaphysis* would have done as well and been correct); but these do not appear in the present connection. Cooperation is the subject of Chapter XII, and development does not so greatly differ from evolution, which is the thing with which it is said to be associated, and is the subject of Chapter XIII. These two new series seem to belong immediately after the categories. The first may be called *processes:* (1) series; (2) metamorphoses; (3) energies or powers; (4) metageneses; (5) reflections. The second may, perhaps, be called *products* or resultant conditions: (1) classes; (2) organisms; (3) cooperations; (4) developments; (5) ideations.

In his final summary (p. 413) the author throws some further light upon his general conception of these interrelated principles. He says that the constituents 'develop into' the categories, and that in so doing both the essentials and the variables 'become' something else, which gives rise to two other new series, here introduced for the first time in any systematic way, although, as in the cases last considered, many of the terms have been discussed, and several of them are the same in form at least as the terms of other series,

but seem here to have entirely different connotations. From his language at this point the following tabular arrangement seems justified:

	Constituents.		*Categories.*	*Essentials.*				*Varieties.*	
1.	As number develops into		class	unity	becomes	kind	and	plurality	series
2.	As space	" "	form	extension	"	figure	"	position	structure
3.	As motion	" "	force	speed	"	velocity	"	path	inertia
4.	As time	" "	causation	persistence	"	state	"	change	event
5.	As judgment	" "	conception	consciousness	"	recollection	"	choice	inference.

No names are given to the series represented by the fourth and sixth columns of this table. The first, third and fifth columns are those respectively of the constituents, the essentials and the variables. The second column would correspond to the categories had he not transferred the first term, kind, to the fourth column, and put 'class' in its place. Perhaps the reverse was intended, and this would seem every way more logical. Making this change we would have as one of the new series: (1) class; (2) figure; (3) velocity; (4) state; (5) recollection, and as the other: (1) series; (2) structure; (3) inertia; (4) event; (5) inference.

Twenty of these cosmic series of philosophic principles have now been enumerated. Others could probably be worked out of the text even as it stands, and the author is doubtless conscious of many more. It may be well to repeat that all these correlations are stated in the form of simple discussions and the tabulation has been made from these. Gaps are often left that must be supplied from remote parts of the book, and in a few cases terms are wanting and have had to be selected from the obvious meaning of the context. The author will, therefore, probably criticise these condensations or perhaps repudiate many of them altogether. The only apology that can be made is that this seemed the only way of putting the contents of the book into a form which could be readily grasped, and if it does not correctly represent the scheme it shows at least that the scheme cannot be understood in its present form. Even should this presentation be accepted in its main aspects it seems doubtful whether it will convey a clear idea to all minds. The terminology is so different from any hitherto employed that attention is constantly arrested on the words at the expense of the meaning. The practice of neoterism has been aptly compared to putting cannon balls inside of bales of cotton whereby their force and effectiveness are destroyed. The strongest writers are not those who use the greatest number of new words, and such a style as Huxley's abundantly proves that the English language, clumsy genetic product as it is, is capable of conveying the deepest scientific and philosophic truth and of expressing the highest and finest shades of thought. The golden rule is never to introduce a new word when an old one will serve the purpose. Major Powell's method reverses this, and he seems never to use a word that has a popular acceptance if he can find a synonym, however rare, or can coin a new term. His use of *demotic* for social, already pointed out, is simply one example in a hundred that might be named. More confusing still, perhaps, is his employment of old words in new senses, as, for example, his use of *apprehension* as a mental faculty, with its opposite *misapprehension*, both of which are in common use with definite though highly derivative significations. His category *kind*, in place of the Kantian *quality*, conveys to the average mind scarcely any idea at all.

We know what his answer to all this

would be, as he never tires of repeating it, viz., that the bane of all thinking is the use of the same word in different senses, whereby the ideas are confused by the sounds of the words. But must we make a new language to obviate this? Is it not due to the muddle-headedness of those who use the words? And will not order come out of this chaos when people learn to think clearly irrrespective of words? It may be compared to the agitation about phonetics. Our language has only 26 letters, but over 40 sounds, and yet many of these letters have several sounds. The spelling reformers say this is illogical. There should be just as many letters as sounds, and each letter should have one sound and one only. All this is true, and no one disputes it. But it is a condition and not a theory that confronts us, and it is found that our alphabet, with all its admitted defects, is capable of forming all the words of the language. Both the forms and the meanings of words are products of evolution and have had their history and genesis, and this evolution is constantly going on far more rapidly than the radical reformers suspect in the direction of rationality and logicality. It is, indeed, observed that attempts at hasty reform in orthography tend to arrest natural development and fossilize language, as witness the practice of dropping the syllable *al* in all adjectives in *ical*, which interferes with an obvious natural differentiation in the meaning of the short and long forms, clearly seen in the difference already acquired between such words as *historic* and *historical*, *politic* and *political*, *microscopic* and *microscopical* (what, for example, would a microscopic society be?).

The natural impulse is to ignore the deficiencies that one sees in a work of this nature and take up the enumeration of the many sterling qualities that it so manifestly possesses, but aside from the fact that this would be quite useless to the reader, since he will see them for himself, one is here confronted with so many actual difficulties in the way of the comprehension of the scheme that it seems necessary to devote whatever space may be left after this attempt at exposition to the consideration of a few at least of these difficulties. There is certainly one salient feature of the work that demands a passing notice. It claims to be 'the Philosophy of Science,' as opposed to 'Idealism,' on the one hand, and 'Materialism,' on the other, and a large part of it is devoted to soundly belaboring both these spurious systems, but especially what the author calls *metaphysics*, which rests upon idealism. The arch-enemy of Truth and chief source of Error is the philosophy which reduces the universe to a subjective state of the thinking or knowing mind. What is elsewhere called 'epistemology,' and is defined as 'the theory of knowledge,' proves uniformly to be a theory of no-knowledge, or a proof that the mind can know nothing but its own states. Major Powell calls this book a treatise on epistemology (which is always written 'epistomology,' as if it had to do with the digestive rather than the cogitative apparatus). But, unlike the current epistemology, its aim is to show that there is an objective, knowable world, the world with which science so effectively deals. All this is well, and no scientific man can object to it. But how does he succeed in this? When, as at the threshold, he approaches the nature of matter he is baffled as completely as the school boy, or as the other savants who have grappled with this problem. He seems to think, however, that he has found a way out of the difficulty. Between the thesis and the antithesis of the second Kantian antinomy he thinks he has found a Hegelian synthesis. This compromise or reconciliation consists in maintaining, as the term implies, that the five 'constituents' *constitute* matter. These constituents, as

we have seen, are number, space, motion, time and judgment. They must all exist in every particle, but besides and beyond them there is nothing. They *are* matter. Sometimes (*e. g.*, on p. 119) he calls these the 'properties of matter.' At other times he seems to talk as though it were rather the five 'essentials' or 'manifestations' (unity, extension, speed, persistence, consciousness) that really 'constitute the particle' (p. 183). But at any rate there is nothing but these properties or manifestations, and when he speaks of 'substrates' he calls the essentials the substrates of the corresponding variables (plurality, position, path, change, choice), and does not mean any real substrate of which any one or all of these attributes can be predicated. Now, to the ordinary mind, or naïve intellect, such things as space, time, motion, or as extension and speed (rate of motion), seem to be wholly immaterial. Some of them, as space and time, are mere conditions under which things exist. Motion we must agree with him in regarding as a state in which all matter always exists. Extension is a property that matter *possesses*. But when Major Powell refers to space he says he does not mean 'void space,' which he says is a pseud-idea. Yet most persons can clearly conceive of void space. He must refer to the matter that is in space. This is simply a question of language. When he speaks of time he says he does not mean 'void time, but the time of states and events' (p. 253). But any one can 'think away' the whole universe of matter and both space and time will remain. He says there is no such thing as void space, and many passages indicate that he accepts the *plenum*. Although this is inconsistent with motion, and even with number, except unity, it will seem to many that if matter is made up of such intangible constituents as space, time, extension, speed, and judgment it makes very little difference whether the universe is *full* of them or not. Like the deathless Shades of Walhalla, hack and hew them as you may, they will instantly regain their forms and return to the combat.

By thus constructing the material universe out of five immaterial elements Major Powell seems to think that he has made his peace with the idealists and won the right to turn upon the materialists. It cannot be denied that he has evolved a system as thoroughly ideal as that of Berkeley, and about the only difference between it and the Berkeleyan idealism is that it consists of five nothings instead of one. For the last of the Powellian nothings, judgment, consciousness, etc., is the whole of the Berkeleyan nothing, mind, and the Hegelian *Nichts*, thought. But are not consciousness, mind, thought, real things and important things? Undoubtedly, and so are justice, honor, truth, freedom, yet no one thinks of making these the constituents of matter and the contents of the material universe. All these numberless terms of elevated and refined thought and sentiment stand for *relations* subsisting among material things, but which are themselves necessarily immaterial, as much so as distance or direction. The number and kinds of relations are innumerable. By a little convenient expansion the term may be made to include space, time, motion, extension, velocity, persistence, resistance, judgment, consciousness, feeling, thought, mind, love, sympathy, virtue, justice, truth, liberty, peace, ambition, character—all the higher and more evolved conceptions of intellectual and emotional beings. But if any one prefers to call them properties, attributes, or even qualities, there need be no objection; they may be any of these things, but they are not matter nor the constituents of matter. Major Powell says that the metaphysicians 'reify' mere properties or attributes. He has reified abstract relations and constructed a phantom world out of nothing.

There is one other favorite idea in this book which it is difficult to resist touching upon, however lightly. It is the doctrine of *hylozoism*, which the author approaches at first haltingly and doubtingly, but which before the close assumes the form of a full-fledged dogma without the acceptance of which it is almost admitted the whole structure falls to the ground. Really there was no occasion for the initial timidity, as the doctrine is backed up by a long line of the best thinkers of all ages. In fact, it is one of those conceptions which cannot be escaped by the mind if only it goes on to the logical term in its reasoning, and it has never been gainsaid in any legitimate argumentation. There need, therefore, be no quarrel as to the notion itself that the highest attribute of nature, call it mind, soul, spirit, thought, or what you may, resides also in the lowest and simplest form of existence. No true philosopher will or can deny this proposition. The 'fallacies,' to use Major Powell's regular word for the errors of human reasoning, all occur in the mode of approaching this great truth. It is so in the present case. His fallacy lurks at the outset in the fifth and last term of the first three or four series of cosmic principles—in the terms judgment, consciousness, concept, choice, etc.—terms which connote psychic processes not introduced in the course of evolution until the cosmic stage had been passed and the organic stage had been ushered in. The fallacy is most manifest in the discussion of the terms 'affinity' and 'choice.' Here our author becomes thoroughly metaphysical. On pages 40 and 41 he says: "We have now discovered that there is an additional property of the inanimate particle when it is incorporated, and that this is affinity. All we know of affinity is that it is the choice of one particle for another as its associate or as their mutual choice. Here we are introduced to the multitudinous phenomena of affinity which can be explained only as choice." On pages 188 and 189 he further says: "The primal law of evolution seems to be psychic. We shall call it the law of affinity and define it as choice of particles to associate in bodies." Finally, on page 267, he asserts that "the ultimate particles of inanimate bodies have self-activity in so far as they manifest choice or affinity." Now this is not 'reification,' which belongs to the metaphysical stage of thought in Comte's celebrated *trois états;* it is 'imputation,' which belongs to the first or fetishistic phase of the theological stage, which, as Major Powell has elsewhere so ably shown, characterizes the thinking of the primordial savage. To the glorious company of Chuar, Spencer and Hegel, Powell must surely be added!

The whole idea of choice or affinity is anthropomorphic. It is to be compared with the popular idea of attraction, or gravitation as produced by one body drawing another through void space; an idea, by the way, which Major Powell justly assails as essentially metaphysical, involving the *actio in distans*, and demanding a belief in some sort of magic. There is no difference between the attraction of bodies and the affinities of atoms, so far as this principle is concerned. To call it 'psychic' is an anachronism. To say that the action of a magnet or an attracting body, or the behavior of chemical substances toward one another, is judgment, or consciousness, or choice, except metaphorically, is to ignore the vast series of steps in evolution which separate the chemical atom from protoplasm and span the chasm between the inorganic and the organic worlds. Hylozoism simply asserts that the elements and raw materials are there, even at the bottom of the scale, but it does not say that a bank of clay is a house of brick, or that a block of marble is a Venus of Milo. The worst feature of this doctrine, which pervades the work and

affects the whole scheme, is that it is quite unnecessary and superfluous. If, as the law of the conservation of energy demonstrates, all matter exists in a state of motion which is as unchangeable and indestructible as matter itself, is its one essential attribute, what more is required? Is not this the true 'self-activity,' the true hylozoism? Everything else follows from this. Every higher manifestation is the result of aggregation, of compounding and recompounding—in a word, of organization, first chemical, then biotic, then psychic. All differences are differences of degree, and the universe is one.

The last question to be asked is: Why pentalogic? Is the universe really a quincunx? Or has it been forced to take this form? We all know how strong the love of symmetry is in man, and too great symmetry in a treatise claiming to be scientific stamps it as artificial if nothing more. It has been said that nature makes only individuals and man make species, genera, families. The real world will not fit into our square or round or oval frames. The mind strains to make it fit. The search for analogies has been universal. The old cosmologies largely go by numbers—by threes, or fours, or fives, or sevens, or twelves. Reasons for this are always at hand—the number of fates, of points to the compass, of fingers on the hand, of days in the week, of tribes of Israel, of apostles, etc. There has never been any difficulty in making a philosophical system conform to any of these charmed numbers. Instead, therefore, of strengthening his argument by referring (p. 112) to the well-known origin of the decimal system in the number of digits, and declaring that 'the universe is pentalogic,' Major Powell has thereby greatly weakened it by an analogy devoid of the least causal connection. Every biologist knows that it was an accident that in the phylogenetic development of the higher animals, from the many-boned fins of fishes through the multidigitate *Dipneusta* to the five-toed Batrachians, the reduction of digits happened to be arrested at this stage. Really, though, it never was arrested, but went on through the cloven-footed ungulates, until in the horse the number was reduced to one; so that the horse is the most highly developed animal, as Professor Cope and Dean Swift agreed in asserting. But this theological argument is further demolished by the superiority of other than pentalogic systems, the duodecimal, and especially the octonal. If four instead of five had been the magic number no one can calculate the economy it would have wrought in human affairs.

The direct study of nature reveals everywhere irregularity, heterogeneity, amorphism, chaos; and however laudable the effort to reduce this anarchy to law and this chaos to cosmos, any attempt in this direction which goes beyond the limit set by concrete facts is, by minds trained to the scientific habit, dismissed at once as not science, whatever else it may be.

It seems a pity that a book which is obviously the product of such prolonged and profound philosophical meditation by a mind so well stored with scientific knowledge and direct experience with the real world should be handicapped in the manner here pointed out. The above specifications in this regard are not meant for criticisms. They are made rather to prepare the reader for what he may expect in the hope that he may ignore them as far as possible and persevere to the end, assuring him that, read in the right spirit, this book will furnish food for reflection and new views of science and philosophy. Meanwhile we commend to the author the two following passages from his book:

"For some purposes of discussion a schematization may be of more or less value, but it easily degenerates into illogical

classification, especially when it becomes the foundation of a philosophy." (Pp. 119–120.)

"The true method of classification is not by invention, but by discovery." (P. 113.)

LESTER F. WARD.

INCONSIDERATE LEGISLATION ON BIRDS.

THE following bill has passed the House, and, as amended by Senator Hoar, has met with the approval of the Senate. If the amended bill meets with the approval of the House Conferees it will probably become a law:

An Act to Extend the Powers and Duties of the Commission of Fish and Fisheries to Include Game Birds and Other Wild Birds Useful to Man:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that the United States Commission of Fish and Fisheries shall hereafter be known and designated as the United States Commission of Fish, Fisheries and Birds. The duties and powers of said commission are hereby enlarged so as to include the propagation, distribution, transportation, introduction and restoration of game birds and other wild birds useful to man. For such purposes they may purchase, or cause to be captured, such game birds and other wild birds as they may require therefor, subject, however, to the laws of the various States and Territories in which they may conduct such operations.

The object and purpose of this Act is to aid in the restoration of such birds in those parts of the United States adapted thereto where the same have become scarce or extinct, and also to aid in the introduction of new and valuable varieties or species of American or foreign birds in localities where they have not heretofore existed.

Said Commission shall from time to time collect and publish useful information as to the propagation, uses and preservation of such birds.

And the said Commission shall make and publish all needful rules and regulations for carrying out the purposes of this Act, and shall expend for said purposes such sums as Congress may appropriate therefor.

The Amendments are as follows:

That the importation into the United States of birds, feathers or parts of birds for ornamental purposes be and the same is hereby prohibited: *Provided, however*, That nothing herein contained shall be construed as prohibiting the importation of birds for museums, zoological gardens, or scientific collections, or the importation of living birds or of feathers taken from living birds without injury to the bird. The Secretary of the Treasury is hereby authorized to make regulations for carrying into effect the provisions of this section.

That the transportation of birds, feathers or parts of birds, to be used or sold from any State or Territory of the United States is hereby prohibited. Whoever shall violate the provisions of this section shall, upon conviction in the district where the offense shall have been committed, be punished for each such offense by a fine of $50.

That the sale, keeping or offering for sale, within any Territory of the United States, or within the District of Columbia, of birds, feathers or parts of birds for ornamental purposes, except such as are excepted in the first section of this Act, be and the same is hereby prohibited. Whoever shall violate the provisions of this section shall, upon conviction, be punished for such offense by a fine of $50.

In view of the high grade of ornithological work which the Department of Agriculture has already performed, and of the eminently scientific character of its personnel, it seems a great pity that work so clearly of an agricultural nature should be given to the Fish Commission, a department which has neither the experiment stations, the men nor the means to effectively undertake such duties, and whose hatcheries are in localities so remote from sources of supply that the work can only be done, if at all, at a great sacrifice of time, money and energy.

The introduction of new species into a country is, in any case, a dangerous ex-

periment—as witness the English Sparrow—and if undertaken at all should be done only under that branch of the government service which for many years has been charged by Congress with investigations of the economic status of birds and mammals. While we should gladly see feathers and parts of birds obtained by killing the birds no longer used for ornamental purposes, it is probable that legislation would accomplish nothing. On the whole, the bill appears useless, and the new functions given to the Fish Commission are extremely ill-advised. Such bills should be referred to a committee of the National Academy of Sciences for an opinion.

ELEVENTH ANNUAL MEETING OF THE GEOLOGICAL SOCIETY OF AMERICA, DECEMBER 28TH, 29TH AND 30TH, NEW YORK.

II.

Origin of the Grahamite in Ritchie Co., W. Va. I. C. White, Morgantown, W. Va.

This mineral, resembling coal in physical aspect, and extending, in a vertical fissure two to three feet wide, downward to an unknown depth, was shown to be a residual product derived from the evaporation of petroleum. Its location is near the 'Oil-break' anticline of Andrews, and it probably tapped off oil from the 'Saltwater Sandstone' of the drillers. This sandstone is now the source of productive wells located near the Grahamite vein.

The paper led to the discussion of asphaltic deposits in fissures and to the source of graphite and other hydro-carbons in pegmatite veins. A. P. Coleman cited the anthraxolite of the Sudbury region, an ultra-anthracitic material in fissures. J. S. Diller mentioned the pitch-coal of the Coos Bay lignite mines, Oregon, which cuts the lignite in veins. J. F. Kemp brought up the graphitic pegmatites of the Adirondacks, the presence of small amounts of carbon in the gabbros and the tarry material in the Branchville, Conn., quartz. M. E. Wadsworth referred to carbon in meteorites.

Structure of the Iola Gas Field, Allen Co., Kansas. Edward Orton, Columbus, O. Read by I. C. White, in the absence of the author.

Natural gas is more widely distributed, geologically and geographically, and exists in larger quantity than any one would have claimed 20 or even 10 years ago. Its productive horizons cover the entire Paleozoic column of the country. Cities supplied, at least partially, with natural gas for fuel and light are no longer uncommon. Two distinct divisions can be made of its accumulations, viz.: That which is *stored* in *impervious rocks* as shales, most limestones, etc., and that which is *found* in *porous rocks*. These divisions may be provisionally styled *Shale gas* and *Reservoir gas*, each having characteristics of its own. *Shale gas* occurs in comparatively small wells. Its wells lack uniformity of rock pressure. It does not occupy definite horizons; it exists independently of petroleum in many cases, has *staying* properties, does not depend on the structural arrangement of the strata that contain it. *Reservoir gas* is found in great wells, approaches uniformity of rock pressure in each subdivision of territory, occupies definite horizons, is accompanied by oil, its wells generally come to a sudden end, is entirely controlled by the structure of the rocks in which it is accumulated. Two structural phases of rocks are specially important in this connection, the *anticline* and the *terrace*. The time has come for the acknowledgment of *structure* in reservoir gas fields even in advance of measurements. The Iola gas field is one of great promise. Its source is in a sandstone of the Cherokee shales, or near the bottom of the coal measures. It proves to be a *terrace* of well-marked character. For seven miles the top of the

gas rock has an elevation of 131 feet above tide, rising at no point more than 45 feet above this. At this summit the largest well of the field is located. The relations were shown by a geological cross-section. The importance of the fuel to the local zinc industry was described.

There was no important discussion.

The Conshohocken Plastic Clays. T. C. HOPKINS, State College, Pa.

THE plastic clays near Conshohocken, Pa., form an isolated deposit. The resemblances to the New Jersey and Gay Head clays in colors, texture and structural features suggest clays of the same age. The location and character of the deposits were briefly described. There was no discussion.

A Remarkable Landslip on the Rivière Blanche, Portneuf County, Quebec. GEORGE M. DAWSON, Ottawa, Ont.

IN this paper a brief account was given of the landslip that occurred on May 7th, last. It affected the thick deposit of Leda clay that floors this part of the St. Lawrence plain and serves to indicate that a clay of this character may, under certain circumstances, for a short time, behave almost as a liquid. The paper was illustrated by the lantern and threw light on disturbed glacial or post-glacial deposits elsewhere.

Ripple-Marks and Cross-Bedding. G. K. GILBERT, Washington, D. C.

THE general theory of ripple-marks, as developed by Darwin and others, was outlined and the relation of ripple-mark dimensions to dimensions of water oscillation was set forth. In general the distance between the crests of the ripple-marks is half the height of the wave that causes them. At the surface the particles sharing in the wave describe circles. In depths the circles flatten to ellipses and at last to forward and backward oscillations, which develop the ripple-marks. Giant ripple-marks of Medina sandstones were described, with crests up to 30 feet apart. The physical conditions in which they were developed were inferred, and waves up to 60 feet high were indicated. When ordinary wind waves are complicated by currents, compound and complex cross-bedding is caused by deposition on rippled surface. The tops of the ripple-marks are cut off and deposited on the flanks of the ridges and lead to cross-bedding of variable dip and strike, which in this way differs from the cross-bedding of deltas and currents. The paper was illustrated by the lantern.

Volcanoes of Southeastern Russia. HARRY FIELDING REID, Baltimore, Md.

DURING the Russian excursion of 1897 the author visited the three very high volcanic mountains, Elbruz and Kazbek, in the Caucasus, and Ararat, farther south. This paper gives a brief description of these mountains and was illustrated by lantern views. The physiography of the region traversed, its lake basins and glaciers were all described. Special attention was given to Mt. Ararat. The supposed thawing of its snow fields by the heat developed from oxididizing pyrites was set before the Society and discussion asked, and the question of the abundance of fulgurites on one peak of Ararat and their scarcity elsewhere was proposed to the Society for explanation.

L. V. Pirsson and others dismissed the pyrites as a source of heat on account of its manifest and absurd inefficiency, despite the fact that it had been seriously advanced abroad. Experience in the Sierras led C. D. Walcott to attribute the absence of snow in certain spots to the action of wind. E. O. Hovey spoke of the occurrence of the fulgurites on Little Ararat, and A. Heilprin remarked their independence of the kind of rock and cited the unusually large ones he had met in the desert of Sahara. He also spoke of the similarity of the profile of

Ararat to that of Shasta, and others said the same of Shishaldin.

The Society then adjourned for lunch.

PETROGRAPHIC SECTION.

On reassembling for the afternoon session the Society divided into two sections, in order to finish the program. The petrographic section listened to the following papers:

Differences in Batholitic Granites According to Depth of Erosion. B. K. Emerson, Amherst, Mass.

The speaker reviewed the distribution of granitic rocks in Massachusetts, illustrating his remarks with a sketch map of it and of the neighboring States to the south. He commented on the tonalite near Northampton, the Cape Ann area, the Quincy area and the extension of quartz porphyries and felsites to the southwest of the last. He outlined another belt of igneous rocks that passes near Worcester. He then developed the idea regarding the tonalite that it had fused its way upward, involving in itself the overlying schists to such a degree that zones can be traced around the granite proper that mark the various stages of absorption or metamorphism of the schists. From the granite outward there is a fibrolitic zone, then a chiastolitic, next an andalusitic and lastly the schists. Given one of these zones, such as the chiastolitic at Lancaster, the presence of the granite may be confidently predicted in depth, although not actually visible. The demarcation of the zones is sharp enough to admit of mapping.

The next two papers followed before discussion.

Metamorphosed Basic Dikes in the Manhattan Schists, New York City. J. F. Kemp, New York City.

Hornblende schists in narrow belts have long been known in the prevailing mica-schists of Manhattan Island. This paper describes one special occurrence on Morningside Park, between 118th and 119th Streets, near the Columbia University Campus. A small detailed map was shown, together with analyses and petrographic details of the amphibolite and of the mica-schists. The speaker stated that the amphibolite must be referred to an igneous intrusion or to limey bands in the schists. The most reasonable interpretation seemed to him to be the igneous. The rocks were illustrated by projecting thin sections with a polarizing microscopic lantern.

The Granites on the North Shore of Long Island Sound, with some Observations on the Granites of the Atlantic Coast in General. J. F. Kemp, New York City.

The general character of the crystalline rocks along the sound from New Haven to Narragansett Bay was outlined, and it was shown that they are chiefly granitic gneisses, with pronounced foliation, but with some augen-gneiss and considerable basic hornblendic and biotitic schist. The granites at Niantic and Westerly, R. I., and at New London, Millstone Point, Stony Creek and some minor localities in Connecticut were discussed. They were shown to be biotite-granites of several varieties. Although they have nearly or quite the same mineralogy as the prevailing gneiss of the region, their intrusive character was shown by their relations to the wall-rocks and by their peculiar inclusions of the basic hornblendic and biotitic schists. The supposed Carboniferous age of the Connecticut granite, as advanced by Pirsson, was mentioned as perhaps indicating a fairly late age for those in the gneissic areas. Slides of the rocks discussed were afterwards thrown on the screen with the polarizing microscope. The remarkable development of pegmatites that everywhere characterize the region was also discussed, both as regards mineralogy and geological relations. They vary from coarse

aggregates of pink microcline, natron-orthoclase, quartz, biotite and ilmenite to practically pure quartz, intermediate varieties being present. The paper concluded with a general review of the granites of the Atlantic sea-board and stated that they are with few exceptions biotite granites. Such analyses as are available were used in illustration.

In discussion of the last three papers M. E. Wadsworth remarked with regard to the amphibolites of the second paper the similar changes in peridotite dikes on Lake Superior and their clear igneous character. In reply J. F. Kemp mentioned the serpentines near New York, which have lately been shown by D. H. Newland to contain recognizable olivine, and which are probably altered basic, igneous rocks. Whitman Cross stated that the Colorado granites with which he was familiar had sharp contacts with the wall rocks and showed no such infusion as described by Professor Emerson. They resembled rather the granites of the Long Island Sound region. M. E. Wadsworth remarked that he had always been able to find evidence of the intrusive nature of massive granites wherever he had searched for it and he controverted the idea that metamorphism was responsible for them. Referring to the supposed post-Carboniferous age of the Conanicut granite J. E. Wolff stated that he and his associates at Cambridge had reached the conclusion that the granite intruded Cambrian and not Carboniferous strata. In reply to the remarks of Whitman Cross, B. K. Emerson again reviewed his interpretation of the Massachusetts phenomena.

Augite-syenite near Loon Lake, N. Y. H. P. CUSHING, Cleveland, O.

AN interesting section exposed in a railroad cut near Loon Lake shows an intrusive rock which has caught up fragments of the Grenville series. The rock is related to the augite-syenites but the chemical, analysis shows some unusual features. A large area of anorthosite mapped in Franklin county, N. Y., the past summer, was found to grade into similar rocks on all sides, and they are, therefore, regarded as variants of the gabbro magma. They present a range from rocks of the acidity of granite to basic gabbros. The analysis quoted was by E. W. Morley and was as follows:

SiO_2 63.45, TiO_2 0.07, Al_2O_3 18.31, Fe_2O_3 0.42, FeO 3.56, MnO none, CaO 2.93, BaO 0.13, MgO 0.35, K_2O 5.15, Na_2O 5.06. Loss, 0.30. Total, 99.73. The rock is composed of microperthite, quartz, hyperstheme, a pyroxene near diallage and a little plagioclase. It was compared with Cape Ann and Norwegian relatives.

In discussion J. F. Kemp remarked the presence of related rocks in the Adirondack region south of Professor Cushing's area and the possibility of others having been pinched into the gneisses and disguised by metamorphism. H. S. Washington emphasized their close parallelism with the Cape Ann varieties described by him. M. E. Wadsworth discussed the passage of Minnesota gabbros into rocks of this type, and N. H. Winchell gave a most interesting review of recent results in the study of the Minnesota gabbros and their relatives. Beginning with anorthosites be showed their passage into gabbros and their occurrence both as inclusions and as segregations in diabases. The gabbros grade into the 'muscovadites' of the Minnesota geologists and the muscovadites into greenstones and perhaps into jaspilite and iron ore. R. A. Daly remarked the presence of the same rocks as those described by Cushing in Mt. Ascutney, Vt., and quoted an analysis that was very much like Cushing's. He outlined the curious change in color that the rock undergoes when quarried. He stated that it also occurs at Cuttingsville in the Killingly Peaks, Vt.

On the Phenocrysts of Intrusive Igneous Rocks. L. V. Pirsson, New Haven, Conn.

The speaker argued for the formation of phenocrysts at or near the places where they are found in rocks, and against the necessity of the generally accepted idea that they are deep-seated and older crystallizations brought up by the magma, *i. e.*, against the necessary 'intratelluric' nature of them. He distinguished the 'single' type which does not occur as a mineral of the ground mass and the 'recurrent' type which does. As incompatible with an intratelluric origin, he advanced the following well-known phenomena: (1) Absence of phenocrysts from contact zones. (2) Absence from dikes and sheets whose parent laccolite is richly provided with them. (3) The throngs of small rod-like crystals that surround phenocrysts and are not flow-phenomena, but due to crowding back, by growth of phenocrysts; further tabular phenocrysts which occur in all orientations in a rock. (4) Phenocrysts of prophyritic granites may or may not be intratelluric, according as we view porphyritic rocks as differing from granitoid in kind or in degree. (5) Micro-structure, both internal as regards inclusions and external as regards surrounding crystals, may be explained by formation near the surface. The arguments for an intratelluric origin, viz.: (1) Large size, and (2) flow-arrangement and resorption-phenomena, were discussed. As opposed to the views of the French petrographers, that there are two distinct periods in the crystallization of every igneous rock, and of the Germans, that there are two for the porphyritic and one for the granitoid, Pirsson argued for only one for each, and emphasized the viscosity of the magma as an important factor in conditioning the epoch of crystallization, and the rate of cooling as of great influence on the result. With a long time, *i. e.*, slow cooling, the granitoid texture results; with a short period, the porphyritic or felsitic. The presence of water-vapor is also important. With a quick fall in temperature the earliest minerals to begin have the best chance to develop; the later ones are hurried or are cut off. Hence, single phenocrysts result. Mass action is also important. The most abundant minerals have a predominant tendency to develop. Too great regularity is not, however, to be expected in Nature. The speaker closed with a statement that he had no hopes of the Section agreeing with him, but he courted discussion. He was mildly thunder-struck to find very general agreement and approval as evinced in remarks by J. P. Iddings and Whitman Cross, although, the hour being late, the paper could not receive the attention that its importance and interest merited.

The last paper of the Section was the following:

The Mica Deposits of the United States. J. A. Holmes, Chapel Hill, N. C.

The speaker stated that to-day all the commercial mica produced in the United States is derived from North Carolina. It is universally obtained from pegmatite dikes, in which as a maximum not or over 1 or $1\frac{1}{2}$ per cent. of the dike is mica, and about 0.1 per cent. is the rule. About 5 per cent. of this mica or less is merchantable as sheets; the rest, if utilized, is ground. The chief defects are the crushing and warping due to dynamic processes, and the so-called 'ruling' or cleavage which runs across the leaves and is probably due to pressure. The speaker described in particular the mica deposits of New Mexico, where the pegmatites are associated with granites at the base of the Grand Cañon series and are older than the Algonkian. They are damaged by folding and pressure, which, however, largely fail in the Appalachian belt. The hour being late, no discussion followed, and after a vote of thanks to the authori-

ties of Columbia University the section adjourned.

GENERAL SECTION.

In the other section, before which papers bearing on glacial geology and some more general topics were read, the following program was presented. The notes of the section on which the following account is chiefly based were kept by Arthur Hollick, but by a misunderstanding they are less complete than those for the previous papers:

Pre-Cambrian Fossiliferous Formations. CHAS. D. WALCOTT, Washington, D. C.

A DESCRIPTION was given of the pre-Cambrian formations which have yielded traces of life, including the announcement of the discovery of fossils indicating highly organized life in the pre-Cambrian belt terrane of Montana. The fossils occur in a fissile black shale or slate called the Empire shales and are of eurypteroid forms. The paper was illustrated by geological sections and by photographs and specimens of the fossils. It was discussed by J. A. Holmes, H. S. Williams, Bailey Willis and H. M. Ami.

After the reading of the paper opportunity was given for the discussion of the papers presented the day before by W. D. Johnson and H. W. Turner. The discussion was participated in by I. C. Russell, H. F. Reid, G. K. Gilbert and W. D. Johnson.

Ice Sculpture in Western New York. G. K. GILBERT, Washington, D. C.

CAREFUL study of the Niagara escarpment in Niagara county shows that its greater features are pre-glacial, but glacial erosion has wrought important modification. The Medina shale has been so deeply sculptured as to obliterate its pre-glacial relief and substitute a broad fluting in the direction of ice movement. At Thirty Mile Point a mass of strata several hundred feet broad has been moved by the ice. The paper was illustrated by charts and was discussed H. F. Reid and Robert Bell.

The Wind Deposits of Eastern Minnesota. C. W. HALL and F. W. SARDESON, Minneapolis, Minn.

THE paper treated of the character, origin and age of the lag gravels and dune sands so frequently seen in eastern Minnesota—more particularly in the district between the Mississippi and St. Croix Rivers. These deposits in the vicinity of Minneapolis have been more particularly studied and their relations to some fossiliferous post-glacial water deposits were considered. The paper was illustrated by photographs and was discussed by Arthur Hollick and J. B. Woodworth.

The Iroquois Beach at Toronto and its Fossils. A. P. COLEMAN, Toronto, Canada.

THE Iroquois beach north of Lake Ontario was long ago mapped in outline by Spencer, but many details in this shoreline remain to be filled in. Near Toronto two bays are found, one near Carlton on the west, the other near York on the east. Each has an area of several square miles and is cut off from the main lake by a gravel bar like the present Toronto Island. Horns of caribou are common in the Carlton bar, and teeth of the mammoth have been found in the bar near York. Fresh-water shells of four species—*Campeloma decisa* the most common—are found in beach gravels of Iroquois age near Reservoir Park, Toronto. These are the fresh-water fossils found without doubt in the Iroquois beach deposits. As the main Pleistocene beaches from Agassiz to Iroquois contain fresh-water shells, they must have been formed in lakes and not arms of the sea. The numerous marine shell-bearing deposits of the east of Canada cease before Lake Ontario is reached. The paper was illustrated by diagrams and by fossil shells.

It was discussed by G. K. Gilbert, Robert Bell and J. B. Woodworth.

Thames River Terraces. F. P. Gulliver, Southboro', Mass.

Cuts have recently been made for a new line of railway on the east bank of the Thames river between New London and Norwich. They expose the structure of many terraces which were regarded as Champlain deposits by the late Professor J. D. Dana, and which were referred to the post-glacial, flooded rivers. The presence of eskers at lower levels has, however, always been a fact difficult of explanation on this hypothesis. The railway cuts expose many delta lobes of fine sand which point down stream and toward the sides of the old valley and rest upon its covering of till. In instances their axes point up side valleys and away from the central axis of the main valley. The fine sand is covered by coarse boulders, such as are found in front of Alaska glaciers. The speaker explained them as due to a retreating glacier which filled the center of the main valley and discharged its waters and sediment laterally as well as longitudinally. This raised the question of possible side-ponds to the glacier, at one or several altitudes and of the corresponding new interpretation of the terraces that would follow as a result of the suggestion.

The Gold-bearing Veins of Bag Bay, Western Ontario. Peter McKellar, Fort William, Ont.

The object of this paper is to show the peculiarities of the gold-bearing veins in the granite area at Bag Bay, Shoal Lake, west of the Lake of the Woods, Ontario. These veins are characterized by the smallness of the quartz fissures compared with the quantity of valuable ore they yield under development. The paper was read by Robert Bell in the absence of the author. At its conclusion the following were read by title:

Stratigraphy of the Pottsville Series in Kentucky. Marius R. Campbell, Washington, D. C.

American Homotaxial Equivalents of the Original Permian. Charles R. Keyes, Des Moines, Iowa.

Geology and Physiography of the West Indies. Robert T. Hill, Washington, D. C.

Surface Features of Northern Kentucky. Marius R. Campbell, Washington, D. C.

Conditions of Formation of Dykes and Vein Fissures. N. S. Shaler, Cambridge, Mass.

Geology of the Crystalline Rocks of Manhattan Island and Vicinity. Frederick J. H. Merrill, Albany, N. Y.

Origin of the Highland Gorge of the Hudson River. Frederick J. H. Merrill, Albany, N. Y.

The Iowan Drift. Samuel Calvin, Iowa City, Iowa.

Loess Deposits of Montana. N. S. Shaler, Cambridge, Mass.

Spacing of Rivers with Reference to the Hypothesis of Baseleveling. N. S. Shaler, Cambridge, Mass.

Glacial Phenomena of the Yukon Valley. J. B. Tyrrell, Ottawa, Canada.

The section then adjourned, after a vote of thanks to the authorities of Columbia University.

The meeting proved a very successful one, 75 Fellows of the 230 of the Society being present.

The following officers were announced as elected for the ensuing year: President, B. K. Emerson, of Amherst College; First Vice-President, G. M. Dawson, Canadian Geological Survey; Second Vice-President, C. D. Walcott, United States Geological Survey; Secretary, H. L. Fairchild, Rochester University; Treasurer, I. C. White, West Virginia Geological Survey; Editor, J. Stanley Brown, Washington, D. C.; Librarian, H. P. Cushing, Western Reserve University; Councillors, J. S. Diller, J. M. Safford, W.

B. Scott, M. E. Wadsworth, W. S. Davis, J. A. Holmes.

The following nominees were elected Fellows: A. R. Crook, Evanston, Ill.; N. F. Drake, Tientsin, China; A. H. Elftman, Grand Marais, Minn.; M. L. Fuller, Boston, Mass.; A. W. Grabau, Cambridge, Mass.; J. H. Pratt, Chapel Hill, N. C.; F. C. Smith, Deadwood, S. D.; F. B. Van Horn, Cleveland, Ohio; T. G. White, New York; S. W. Williston, Lawrence, Kansas.

J. F. KEMP.

COLUMBIA UNIVERSITY.

WINTER MEETING OF THE ANTHROPOLOGICAL SECTION OF THE AMERICAN ASSOCIATION.

THE third winter meeting of the Anthropological Section of the American Association for the Advancement of Science was held in New York on December 27th and 28th. The sessions, which were three in number, and were immediately followed by the meeting of the American Folk-lore Society, took place in the buildings of Columbia University. The attendance was materially greater than at Ithaca last winter, and in general the meeting was successful and enjoyable. The chairman, Professor Cattell, presided, and Dr. M. H. Saville was Secretary.

Eleven papers were presented, two read in abstract, and several read by title. A commendable feature of the program was its grouping of related papers. Thus the first session was devoted to physical anthropology, the second to archæology and the third was generally ethnological. It was found impracticable to follow this scheme rigidly, but it was observed sufficiently to give the discussions more distinct tendencies and greater coherence.

The first paper read—one of more than ordinary value and interest on account of its dealing with aims and methods rather than material—was by Dr. Franz Boas, and was entitled 'Some Recent Criticisms of Physical Anthropology.' The first objection considered was the assertion that any classification of mankind by physical anthropology must be valueless because it has been found impossible to identify positively an individual, at least from his skeleton, as belonging to a group. The answer to this criticism was found in the fact that the physical anthropologist studies not individuals, but geographical or social groups. He does not concern himself with assigning individuals to groups, but with marking the differences and relationships of groups as such. That is to say, physical anthropology deals with types, not persons, and the types can be clearly distinguished and classified. Of course, the significance of the type or group depends largely on its stability, and whether there is such stability depends upon the question whether heredity or environment influences anatomical changes to a greater degree, and this question can be finally solved only by an exhaustive statistical study of several generations. Meanwhile, however, heredity would seem to be the more potent, as various evidence instanced appears to show. Hence it is concluded that the types studied by the physical anthropologist are permanent and not fortuitous or meaningless, and, therefore, allow of classification. The rest of the paper was devoted to a consideration of objections to the metrical method. The values of this method, especially in giving information obtainable in no other way, were insisted upon. But the necessity of all measurements made having some biological significance was strenuously urged. Especially useless, even harmful, were sweeping classifications by merely one arbitrarily-chosen measurement, such as those based upon the cephalic index alone.

Dr. Ales Hrdlicka followed with a paper upon the 'Negro Problem.' Dr. Hrdlicka analyzed and refuted the common belief

that, relatively to the white, the negro is decreasing. The greater increase among whites is due in large part to immigration. Without this factor, which has generally been overlooked, white increase is smaller than negro. This is borne out by the higher birth-rate among negroes. The present compensation of a higher infant mortality will tend to disappear as the negro is raised. Consequently we shall soon be confronted with the circumstance of an ever greater proportion of negro population. The author reviewed various methods of dealing with the negro problem, finally advocating that of dispersion.

Dr. Thomas Wilson presented a paper upon modes of lighting museums, embodying the results of investigations made by him upon the transparency of kinds of glass, illustrated by photographs. A paper by Mr. Roland B. Dixon upon 'Color Symbolism of the Cardinal Points' concluded the morning's session. The paper was devoted largely to a discussion of the various bases of association of colors with directions, such as light, climate, geographical position, religion; with the conclusion, reached also in the ensuing discussion, that there is no such principle of association that is universal.

The afternoon session was devoted to archæology, and it is perhaps a significant fact that all the papers dealt with the extreme western portion of the continent. Dr. M. H. Saville presented a brief paper upon the 'Mexican Stone Yoke,' which he concluded to be a symbol of death. The other papers on the program were: 'Contents of a Room Excavated in the Ruins of Pueblo Bonito, showing a Specialized Form of Pottery,' by Mr. J. H. Pepper; 'Archæological Investigations on the North Pacific Coast of America,' by Mr. H. I. Smith; 'The California Indians,' by Professor McGee; and 'Archæological Problems of California,' by Professor Holmes, the last mentioned being postponed to the following session. Professor McGee's extremely interesting paper opened a discussion as to the causes of the linguistic diversity of certain regions, such as California; and Professor Holmes demonstrated very clearly the great improbability of the remains in California auriferous gravels, including the Calaveras skull, dating back, as has been claimed, to Middle Tertiary times. Owing to the specialized and generally miscellaneous character of all these papers, it is impossible even to attempt a summary of them. But one point which they all made and emphasized in common seems to deserve mention: the complete, or at least great, resemblance of the archæological finds to articles of culture of the present time in the same localities.

The second day's session, at which Professor McGee presided, was opened by Major Powell, with a paper on the 'Science of Estheology.' Major Powell's entire paper was schematic, as well as exhaustive, and this, together with the fact that the system he presented is but part of a larger systematization, renders it impossible to do it justice by reference to one or two of its points. Mr. James Mooney discussed the Indian Congress at Omaha. He spoke of the growing recognition which this method of ethnologic exhibition was gaining, and dwelt upon the especial opportunities at expositions. The Omaha Congress deserved high praise for the general arrangement of the exhibits and the ingenuity of many of the plans. The unrepresentativeness of the tribes collected, however, was a serious, and on the whole, avoidable defect.

Papers by Miss Cornelia Horsford, on 'Cairus in Southwestern Norway,' which reveal great likeness to those found on the Massachusetts coast, and by A. S. Gatchet, devoted to showing the radical identity, in various American languages, of the terms for real and true, and male, were read in

abstract. The following papers were read by title: 'The Structural Peculiarities of the Eskimo of Smith Sound,' by Dr. G. S. Huntington; 'On the Names Glooscap and Illa Tichi Uira Cocha,' by Mr. Stansbury Hagar; and 'Belief in Will-Power Among the Pawnees,' by Miss Alice C. Fletcher. Dr. Boas represented the anthropologists in the discussion before the Society of Naturalists, and the Section took part in the other exercises and entertainments provided for the affiliated societies.

A. L. KROEBER.

SCIENTIFIC BOOKS.

Revised Text-Book of Geology. By JAMES D. DANA. Edited by WM. NORTH RICE. American Book Company.

It is now more than sixty years since the late Professor Dana produced, in 1837, his first important work, a System of Mineralogy. During subsequent years, down almost to the day of his death, in 1895, he was engaged at frequent intervals in writing or revising the several important text-books of geology and mineralogy that have done so much during the last half century to arouse among English-speaking students an intelligent interest in those subjects.

The first edition of 'A Manual of Geology' was published in 1862, the more elementary work, 'The Text-Book of Geology,' following in 1864. So great has been the popularity of the briefer work that extensive revisions were made by the author in 1874 and 1883, while the final revision, begun by him just before his death, has been admirably carried to completion, in the spirit of his old master, by Professor Wm. North Rice, of Wesleyan University.

Professor Rice started out with the plan of retaining the distinctive characteristics of the book, bringing it down to the present time as regards its facts, but still expressing Professor Dana's well-known opinions. Although the general plan of arrangement has been kept unaltered in the main, some radical changes have been made in the interpretation of geological phenomena. Especially is this shown in the treatment of the subject of metamorphism, where the editor takes a very different view from that held by Professor Dana, and one in harmony with modern thought, when he states that the crystalline schists are 'undoubtedly derived in some cases from granites and other plutonic rocks, a schistose structure being developed by pressure and shearing.'

Another change less radical in its character, but affecting the whole work, is the fuller recognition given to evolution as a factor in geological history. The editor states that from this standpoint he has entirely rewritten the closing chapter, in which the general bearing of paleontology upon evolution is discussed.

The zoological and botanical classifications are much modernized, although the anglicized terminology used by Professor Dana in earlier editions is for the most part followed. Professor Dana's plan of terminating names of rocks in *yte* in distinction from the names of minerals which terminate in *ite* is abandoned on the ground that the innovation in nomenclature has not been adopted by other writers.

In general, however, Professor Rice has faithfully reproduced the well-known opinions of Professor Dana in his revision, but has introduced enough in the way of modern views to make the book a most acceptable addition to our list of elementary text-books of geology. It is not an easy task to revise the work of another, and it often involves much more labor than writing the entire book anew. Professor Rice is to be congratulated on the success of his labor of love in revising 'The Text-Book of Geology,' which, from the earlier relations of teacher and student, he states was entered upon with something like a feeling of filial obligation.

W. B. CLARK.

JOHNS HOPKINS UNIVERSITY.

The Groundwork of Science. A Study of Epistemology. By ST. GEORGE MIVART, M.D., PH.D., F. R. S. New York, G. P. Putnam's Sons; London, Bliss, Sands & Co. 1898. Pp. xviii + 328.

This book forms the second volume of 'The Science Series,' which is now appearing under the editorial supervision of Professor Cattell and Mr. F. E. Beddard. "Each volume of this series," the prospectus sets forth, "will

treat some department of science with reference to the most recent advances, and will be contributed by an author of acknowledged authority." The book before us represents epistemology, or the science of knowledge, in this series. It does not, as one might perhaps expect from the title, treat primarily of the methods of science, or of the fundamental conceptions which science employs, but deals with the essential nature of knowledge, or 'science' in the broader sense, as developed by the human mind, in its relation to a world of real objects.

The table of contents shows the following list of chapters: (I.) Introductory; (II.) An Enumeration of the Sciences; (III.) The Objects of Science; (IV.) The Methods of Science; (V.) The Physical Antecedents of Science; (VI.) The Psychical Antecedents of Science; (VII.) Language and Science; (VIII.) Intellectual Antecedents of Science; (IX.) Causes of Scientific Knowledge; (X.) The Nature of the Groundwork of Science. The author regards as futile all attempts to furnish either a systematic or a historical classification of the sciences. He, therefore, contents himself with an enumeration of them, indicating briefly at the same time some of their more general logical relations.

It will be of advantage to state at once the principal results of the book, and thus to show the main theses which the author defends against what he regards as certain more or less widely prevalent tendencies of the present age. These are as follows: (1) The continuous existence of the Self or Ego; (2) the existence of a real world of extended things in themselves; (3) the necessity of assuming as intuitively known certain propositions which cannot be proved; (4) the possibility of absolute scientific certainty about some things; (5) the existence of breaches of continuity at certain points in the world-process, as, for example, between the organic and the inorganic, between insentient and sentient organisms, and especially between merely sensuous and emotional states of consciousness and the intellectual or rational life; (6) the inadequacy of a purely mechanical or naturalistic theory of evolution, and especially the impossibility of explaining in this way the various forms of life, and the intellectual and moral nature of man.

We may now look a little more closely at one or two of these propositions. The long chapter, 'The Objects of Science' (pp. 34–88), is occupied almost wholly with a refutation of idealism. The author feels "that if idealism were true, the authority and certainty of other self-evident truths would be gravely compromised, especially if a truth so self-evident as the existence of our own body (as we and most men understand that body to exist) were but an illusion and self-deception of the mind" (p. viii). Unfortunately, Mr. Mivart is here fighting a product of his own imagination. He regards idealism as the doctrine which denies the existence of an external world, and which can be summed up in Berkeley's somewhat unfortunate phrase, 'the *esse* of things is their *percipi*.' His own arguments consist mainly in an oft-repeated declaration that "we have an intuitive knowledge of the external world as extended. "This, of course, is as obvious an example of *ignoratio elenchi* as were the appeals of the Scottish philosophers to 'Common Sense' in behalf of what neither Berkeley nor anyone else has ever dreamed of denying. Moreover, the assertion in this chapter that there is a world of things in themselves, existing apart, and not dependent upon any mind, is sufficiently refuted by the passage with which the book closes. There we are told that "the action of an all-pervading but unimaginable intelligence alone affords us any satisfactory conception of the universe as a whole, or of any single portion of the cosmos which may be selected for exclusive study" (p. 321). In spite of the author's protestations, then, we shall have to regard him as an idealist, in exactly the same sense as we regard Aristotle and Hegel as idealists.

Numerous discussions are devoted to the question of intuitively certain or self-evident truths. The author's position seems to be that all inference rests upon the existence of certain indemonstrable propositions, which have to be accepted as intuitively self-evident (pp. vi, 103 ff, 240 f., 309). These truths are of an entirely different order from the facts known to us by perception or by inference. Each is known as certain and necessary in itself, and this cer-

tainty and necessity are not derived from its relation to anything else. Moreover, these truths are directly apprehended by our power of intellectual intuition (p. 104). It is those fundamental certainties which constitute 'the groundwork of science,' and the author enumerates the list several times with what appears to be slight variations (pp. 106, 241 ff., 310 ff). In this list are found: (1) the possibility of absolute certainty; (2) the existence of an external world of real objects; (3) our own substantial and continuous personal existence; (4) the possibility of drawing conclusions from premises; (5) the existence of self-evident truths; (6) the law of contradiction; (7) self-evident axioms; (8) the principle of causality; (9) the principle of uniformity; (10) the fact that some things are contingent and some necessary.

It is well-known that Aristotle maintained that all knowledge presupposes the existence of certain self-evident propositions which neither require nor are capable of proof. The earlier Scottish philosophers, also, adopting the same position, made several attempts to furnish lists of self-evident truths. But this doctrine no more belongs to the philosophical thought of to-day than does 'phlogiston' to modern chemistry, or 'vital force' to biology. In the first place, experience has shown that each thinker who defends intuitive truths is likely to have certain propositions of his own which seem to him specially sacred, and which he is anxious to place beyond the pale of examination and criticism. Secondly, what we believe to be a truer conception of the nature of mind, has led us to see that all knowledge is organic —that all of the facts of our experience are interrelated and mutually dependent. There are no truths, then, which are isolated and self-sufficient; every fact is known to be true and necessary only through its connection with other facts. The so-called self-evident propositions must be proved and justified in exactly the same way in which scientific hypothesis are shown to be true. Thus, for example, when I say that it is self-evident that an external world exists, or that nature is uniform, I mean that these propositions are obviously true because in no other way can I account for the facts of my experience. The proof in these cases may be easier and more convincing than the demonstration of the natural-selection hypothesis, but the former are no more *self*-evident than the latter.

If space permitted, I should like to examine in some detail the doctrine of new beginnings, 'breaches of continuity,' at certain points in the world process. Here, again, it seems to me that the conclusions reached by Mr. Mivart are not in accord with the results of modern scientific and philosophical thought. The modern defender of teleology does not, it seems to me, rest his case upon breaches of continuity in natural law, or upon new beginnings at this point or that. He rather insists that no part of the world—not even the inorganic—can be completely understood without regarding it as the manifestation of an energy in some way analogous, at least, to his own intelligence. If Mr. Mivart had made use of the idealistic principle which he so clearly expresses at the end of his book, and to which I have already referred, he would have found a surer defence against materialism, and would have avoided what must seem to many scientists an attempt to introduce final causes into the field of natural science.

In conclusion, I can not refrain from saying that it seems to me unfortunate that this book should represent Epistemology in a series which undertakes to deal with the most recent advances in the various sciences. The volume doubtless contains a good deal that is interesting and suggestive; but, at the same time, it is at once evident that the writer's special work has been in a different field from that of Epistemology. It seems to me that it is sufficiently clear, from what has been already said, that the author has not followed at all the epistemological discussions of the last twenty years. I add two or three illustrations of very serious confusions with regard to the facts and problems of modern philosophical systems which are not uncommon in the book. "The whole philosophy of Germany and Holland," we are informed, "from Spinoza to Hartmann, has been the result of the mental seed first sown in men's minds by Berkeley, who explicitly produced what was implicitly contained in Locke" (pp.

40–41). This is truly wonderful in view of the fact that Spinoza was dead eight years before Berkeley was born! But even with regard to the later philosophers, the statement is thoroughly misleading. Again, the author might have learned from any standard history of philosophy, without even looking inside Fichte's works, that the statement that 'Solipsism was first developed and upheld by Fichte, though he ultimately abandoned it' (p. 83), is wholly unwarranted. Finally, Mr. Mivart in denouncing the futility of the question: 'How is experience possible?' supposes that Kant and others who have formulated the epistemological problem in this form raised an absurd question as to whether knowledge does or does not exist, and apparently does not at all understand that they were inquiring what conditions its actual existence implies (pp. 56, 275).

Why should one write on a philosophical subject without special knowledge, any more than on biology or physics?

J. E. Creighton.

Cornell University.

The Freezing-point, Boiling-point and Conductivity Methods. By Harry C. Jones, Instructor in Physical Chemistry in Johns Hopkins University. Easton, Pa., Chemical Publishing Co. Pp. 64. Price, 75 cents.

In this book, which is intended as a laboratory guide, the author has not only included the mechanical processes, but has discussed briefly the principles upon which these methods are based. The subject is treated under three heads. In the first part the historical development and applications of the freezing-point method are discussed, as is the boiling-point method in a similar manner in the second part. In the third part the method used to determine the conductivity of solutions and the applications of this method are described. An apparatus for use in the boiling-point method is described by the author which is much simpler than the Beckmann apparatus and very rapid and accurate in its results. The methods described in this book can be carried out in a short time and should be tried by every student of chemistry who is interested in the methods which have done so much to advance our ideas of the nature of solutions. J. E. G.

Outlines of Industrial Chemistry. A Text-book for Students. By Frank Thorp, Ph.D., Instructor in Industrial Chemistry in the Massachusetts Institute of Technology. New York, The Macmillan Co. 1898. Pp. xx+543.

This book aims to furnish an elementary course in Industrial Chemistry suitable for students in the schools of technology. The subjects treated are broadly classified under the heads, 'Inorganic Industries' and 'Organic Industries,' about one-half of the book being devoted to each. Metallurgy has been entirely omitted. Otherwise the topics selected for discussion are essentially the same as in other similar works. The descriptions of processes, while necessarily concise, are clear and interesting. The author has evidently made a careful study of recent methods of manufacture as well as of older, standard processes. The frequent reference to American practice is an important feature which distinguishes the book from other works on chemical technology. A select bibliography follows each subject, and will be found very useful to those wishing to study any topic in greater detail.

W. A. Noyes.

Aperçus de taxinomie générale. Par J. P. Durand (de Gros). Paris, Felix Alcan, Editeur. 1899.

The title of this book leaves one somewhat in the dark as to the nature of its contents, but a brief perusal shows that its mission is not so much to tell us how to classify as how not to classify. Not that the author does not believe in classification; on the contrary, he considers that everything should be classified and may be classified, provided we adopt the proper methods. What these methods are we are not told; for, after exhorting us to set about fashioning the general science of classification without delay, M. Durand hastens to add that he himself proposes to take no hand in so important an undertaking, preferring rather to stand by and criticise the efforts of others. Towards all existing schemes the attitude of the author is very much like that of the ship-wrecked Irishman who, as he crawled up the beach of the desert island, waved a piece of driftwood about his head, exclaiming: "Whatever form of gov-

ernment I'm under I object to it!'' This general dissatisfaction with the present order of things is evinced even in the title, where we find taxinomy instead of taxonomy, this latter word being rejected on the ground that its formation is vicious, a view that should meet with the approval of sticklers for nomenclatorial purity.

Nevertheless, four chapters are devoted to as many orders, or categories, of classification, namely, those of resemblance, structure, degree, (*hierarchie*) and phylogeny (*evolution*), all of which are treated as if they were new discoveries. These chapters contain numerous familiar examples of taxonomic methods as well as sundry ingenious diagrams, all very good in their way, but all more or less familiar to everyone who has hat do explain the principles of zoological classification. We are, then, given a discourse on 'the ternary correlation of the four taxonomic orders,' after which M. Durand proceeds to pour the vials of his wrath upon taxonomists and taxonomic systems in general and Haeckel and his genealogical tree in particular. After this we are told that genealogical classification is the only natural method, those founded upon remembrances all being artificial, since they are based upon arbitrarily chosen characters. It is hardly worth while to pursue the subject further, but it may safely be predicted that few will share the author's conviction that his statements are definite and firmly-established facts upon which we may confidently build.

F. A. L.

BOOKS RECEIVED.

Minerva, Jahrbuch der gelehrten Welt. Edited by K. TRÜBNER and F. MENTZ. Strassburg, Karl J. Trübner; New York, Lemcke and Buechner. 1899. Eighth year, 1898–1899. Pp. xxiv+1139.

Transactions of the American Climatological Association for the year 1898. Philadelphia, Printed for the Association. 1898. Pp. xxxiii+243.

The Second Washington Catalogue of Stars, together with the annual results upon which it is based. Prepared under the direction of JOHN R. EASTMAN. Washington, Government Printing Office. 1898. Pp. lxi+287.

The Last Link, Our Present Knowledge of the Descent of Man. ERNST HAECKEL. With notes and biographical sketches by HANS GADOW. London, Adam and Charles Black; New York, The Macmillan Company. 1898. Pp. 158. $1.00.

The Principles of Agriculture. L. H. BAILEY. New York, The Macmillan Company. 1898. Pp. xx+300.

The History of Mankind. FRIEDRICH RATZEL. Translated from the second German edition by A. J. BUTLER. With introduction by E. B. TYLOR. London and New York, The Macmillan Company. 1898. Vol. III. Pp. xiii+599.

SCIENTIFIC JOURNALS AND ARTICLES.

The Journal of Physical Chemistry, November. 'Potassium Chlorid in Aqueous Acetone,' by J. F. Snell; a study of what the author calls, at Professor E. B. Titchener's suggestion, the *dineric* surface for the system potassium chlorid, acetone, and water. 'On the Heat of Solution of Liquid Hydriodic Acid,' by F. G. Cottrell; liquid hydriodic acid proves to be an endothermic compound with reference to gaseous hydrogen and solid iodine, but its heat of decomposition is only a little more than a quarter of that of the acid in the form of gas. 'Note on the Transference Number of Hydrogen,' by Wilder D. Bancroft. 'Alcohol, Water, and Potassium Nitrate,' by Norman Dodge and L. C. Graton; a study of the concentration-curve.

December. 'The Conversion of Ammonium Thiocyanate into Thiourea and of Thiourea into Thiocyanate,' by John Waddell; the conversion of thiocyanate into thiourea takes place very slowly, if at all, below 110°, but above 150° is rapid and equilibrium is reached, whether starting from the thiocyanate or from thiourea, when the product contains a little more than 20 per cent. of thiourea. 'Solution Densities,' by H. T. Barnes and A. P. Scott; a study of the density curves for different concentrations of solutions of zinc, magnesium, cadmium, potassium and sodium sulfates, magnesium, zinc, potassium and sodium nitrates, potassium and sodium chlorids, hydrochloric and sulfuric acids. 'Electromotive Force between Amalgams,' by Hamilton P. Cady.

American Chemical Journal, January. 'Metathetic Relations between certain Salts in Solution in Liquid Ammonia:' By E. C. Franklin and C. A. Kraus. 'Some Properties of Liquid Ammonia:' By E. C. Franklin and C. A. Kraus.

The great similarity of liquid ammonia and water in their dissociating power has led to a thorough study of the properties of liquid ammonia. It was found that in a considerable number of cases the nitrates of the metals were acted upon, when in solution in liquid ammonia, by the ammonium salts and a salt precipitated as a result of the metathetic reactions, if the salt formed was insoluble in ammonia. It was also found that many of the physical constants, which in the case of water are so entirely different from those of all other liquids, are almost as strongly characterized in the case of ammonia as in that of water. 'On the Constitution of the Phenylhydragones:' By P. C. Freer. 'Note on the Action of Liquid Hydriodic Acidon Ethylether:' By F. G. Cottrell and R. R. Rogers. In this case there was a partial conversion of the ether into ethyliodide. 'Contributions to our Knowledge of the Oil of Lemon-Grass:' By W. Stiehl. Isolation of the three aldehydes: Citriodoric aldehyde, Geranial and Allo-lemonal. The *American Chemical Journal* will hereafter appear monthly, and two volumes will be issued yearly. J. Elliott Gilpin.

We have received the first issue of *Science Work, a Monthly Review of Scientific Literature*, edited by Mr. Waller Jeffs and published at Manchester by Messrs. Robert Aiken & Company. It is stated in the introduction that the Journal 'will aim to give a general review of the world of science and present the reader as it were with the cream of the scientific press,' but we fear that it will be difficult to do this within the limits of eight pages published twelve times a year.

Natural Science, now published by Mr. Henry J. Pentland at Edinburgh, and still edited anonymously, but under new auspices, opens with the issue for January its fourteenth volume. The general character of the contents, which has always made *Natural Science* interesting and profitable, is well maintained.

SOCIETIES AND ACADEMIES.

GEOLOGICAL SOCIETY OF WASHINGTON.

At the regular meeting of this Society held in Washington, D. C., January 11, 1899, Mr. Willard D. Johnson, U. S. G. S., read a paper on 'Subsidence Basis of the High Plains,' and Dr. C. Willard Hayes, U. S. G. S., one on the 'Lake Region in Central America.' Dr. Hayes' paper was based upon observations made recently in Central America while working under detail as geologist to the Nicaraguan Canal Commission. Abstracts of both papers follow.

Subsidence Basins of the High Plains.—The Great Plains structural slope has been superficially modified by streams from the Rocky Mountains, in three stages of gradation—a first stage, in which a hard-rock topography was developed by degradation; a second, in which this topography, by aggradation, became buried under an alluvial waste sheet to depths within its valleys as great as 300 feet; the third and present stage, in which the mountain streams are again engaged in cutting and have trenched the aggradation plain with parallel valleys, wide apart. But left thus above grade, this flat surface, in the greater part, has been eroded also by the drainage from its local precipitation. In notable exception is a transverse, mid-slope belt. Here the flat surface suffers no erosion from its local precipitation and has virtually no local drainage. It therefore stands in light relief. Transected by the mountain streams into broad plateaus of faint elevation, it forms a belt of residual tables or upland flats of survival. The Staked Plains plateau, of northwestern Texas, constitutes the best individual example. These are the High Plains—to some extent locally so-called. The Great Plains slope has a graduated climate—from humid to arid, east to west. The High Plains correspond in position to its 'subhumid' belt.

In the arid belt to the westward the vegetation—of grass and brush—grows in tufts. It affords but slight protection against the feeble precipitation, and the surface is conspicuously eroded. Upon the High Plains, within the subhumid belt, however, vegetation is wholly of grass, which forms a universal, close-knit sod. This vegetal cover affords complete protection against the considerable local precipitation. The High Plains are distinctively the 'short-grass country.' As a residual topographic belt, within the climatic belt, they are held by their sod. The local precipitation—so much of it as does not evaporate—is absorbed.

These uneroded tables, however, have a faint topography due to subsidence. The flat surface is extensively pitted with saucer-form depressions. Their dimensions vary from a foot or two in depth and a breadth of 100 feet to 75 feet in depth and a breadth of two or three miles. Wind action is plainly to be excluded. Occasionally they are surrounded, upon the hard, sod flats, by concentric cracks, deep enough to cause injury to cattle and to entrap calves.

These forms, large and small, without differences in type, are attributed to the operation of two distinct and unrelated processes: (1) settlement and compacting within the deep and unconsolidated mass of silt sand and gravel, through instrumentality of the ground-water; and (2) solution of salt and gypsum, and consequent caving, within the rocks of the floor, where those rocks are the Red Beds.

The concurrence of two unusual causes, to produce, alike, within a limited area, a result so unusual, appears, however, to be intelligible on this assumption, viz.: These processes are, in fact, of universal operation; they are at the same time of too light effect to stand a chance in competition with erosive agency; but the sod-covered, subhumid plains, remarkable in that they retain a flat surface unscored by erosion, afford exceptional opportunity for the preservation of their delicate record.

The Lake Region in Central America.—The region described includes southern Nicaragua and northern Costa Rica, extending from 10 degrees and 30 minutes to 12 degrees and 30 minutes north latitude, and from the Carribean to the Pacific. It includes the route of the projected Nicaragua Canal and the largest lakes of the western hemisphere south of the glaciated region of North America. The region is characterized by two types of topography, viz.: (1) the recent volcanic ranges and plateaus in which the original constructional forms are more or less perfectly preserved; and (2) the areas of Tertiary, igneous and sedimentary rocks in which the drainage is mature and the forms are due to long continued subaerial erosion. A noteworthy feature is the absence of any continuous mountain range or chain of dominant peaks through this portion of the isthmus. A shallow depression occupies the western portion of the region, its longer axis being nearly parallel with the Pacific coast. This contains Lakes Nicaragua and Managua. The former is 110 miles in length, with an area of 3,000 square miles and a mean altitude of 106 feet. Its greatest depth is 200 feet.

The climate of the region is tropical and insular, the annual range of temperature being small. The rainfall is greatest on the east coast, nearly 300 inches at Greytown, and decreases somewhat uniformly westward, being less than 80 inches on the west coast. Connected with the decrease in the rainfall there is a striking change in the character of the vegetation, the dense tropical jungle of the east coast giving place to open forests and savannahs in the west.

No rocks older than the Tertiary are formed along the line of the canal. They consist of eruptive and sedimentary formations, the former including basalt, andesite and dacite, and the latter calcarious sandstones and shales. In addition to these Tertiary rocks there are extensive recent alluvial deposits and the tuffs and lavas of the modern volcanoes. The conditions throughout the region, but particularly in its eastern portion, are favorable for rock decay, and the regolith is unusually extensive.

The late geologic history of the region is briefly as follows: In early Tertiary time this portion of the isthmus may have been wholly submerged. At any rate, marine sediments were deposited throughout a considerable part of its extent, and this was accompanied by intense volcanic activity. In middle Tertiary time there was an uplift and long continued erosion, the constructional volcanic topography being obliterated, and the region, at least toward the south, being reduced to one of low relief. The present basin of Lake Nicaragua was then occupied in part by a gulf connected with the Pacific to the northwest and in part by the valleys of tributary streams. The continental divide then occupied the hilly or mountainous region east of the lake, crossing the present San Juan valley near Castillo. In late Tertiary or post-Tertiary time the isthmus was elevated at least 300 feet and deeply dissected. Following the elevation was a renewal of volcanic activity. A series of vents opened on the

Pacific side and their ejecta built a dam across the outlet of the gulf, thereby forming the lake basin. As this dam increased in height the waters behind it were raised until they overtopped the continental divide and escaped to the Atlantic, forming the present San Juan. The region has suffered a recent depression by which the rivers were drowned, and their estuaries thus formed have since been silted up.

Wm. F. Morsell.

DISCUSSION AND CORRESPONDENCE.

MATTER, ENERGY, FORCE AND WORK.

To the Editor of Science: In the generous and appreciative review by Professor Mendenhall (in Science, p. 24, January 6) of my book on 'Matter, Energy, Force and Work' there occurs a line to which I would like to advert briefly. "'The something' which distinguishes *substance* from *matter* is *energy*. 'A designated quantity of substance consists of a definite quantity of matter in permanent association with a definite quantity of energy or motion.' The two words 'or motion' render this statement somewhat obscure. What is meant by a 'definite quantity of motion?' Professor Holman's definition of motion is that of nearly all writers, namely, 'change of relative position.' It is a curious but common practice to define it in this way and then to define its 'quantity' by associating with it something (matter, mass) absolutely unlike it in every respect. It is certainly not in this sense that he means to use it in the phrase above quoted."

I desire to express my assent to this comment and to reply to the query therein contained, or rather to remove, if I may, the obscurity. This result will, I think, be effected if for the words 'of motion' in the description of substance be substituted the phrase: *or permanently endued with some definite mode of motion.*

May I also add, to preclude possible misapprehension, that the proposition 'Continuous, uniform, and permanent occupancy of space,' quoted at page 25, is one which I do not advance as a definition of matter, or as a logical deduction from known premises, but only as a possible view of matter if the *unproved* hypothesis of the kinetic nature of all energy be adopted as a step in the inference.

With sincere thanks for your courtesy in presenting this review, I am

Yours truly,

Silas W. Holman.

Brookline, Mass., January 17, 1899.

ZOOLOGICAL BIBLIOGRAPHY.

To the Editor of Science: Dr. Dall's 'tolerably active and rather long experience' has been singularly blessed if he has never met with an advance copy of a paper issued at an uncertain date, not offered for sale, and conflicting in its contents with some other paper offered for sale at a known date about the same period; if he or the libraries he frequents have always been able to purchase without a delay of more than one year the new books or pamphlets that he wanted to see; if he has always had so much as a printed postcard in reply from authors whose works he has sought in exchange for his own; and if he has always been able to find the address of every writer with whom he wished to communicate. A restricted and short experience has acquainted me far too thoroughly with all these difficulties, but, as this is not an autobiography, the details need not be inflicted on your readers. Dr. Dall shall have them if he wishes.

Apart from his scepticism, Dr. Dall appears to agree, at least in spirit, with the proposal that he has now twice criticised. But two remarks of his seem to call for reply.

My committee has not yet definitely pronounced on the question: What constitutes publication? But it is safe to say that it does not regard printing as publication, and therefore sees no great value in placing 'the actual date of printing' on every signature. This, too, may be said: That a *British* Association Committtee would never recommend an author to sell his papers without an express agreement with the society that has been at the expense of setting up the type, and perhaps of drawing the plates. In our country this may be done, but it is not regarded as particularly creditable to the author that does it. Customs are, no doubt, different elsewhere; but our proposal was an attempt to render the speediest possible publication compatible with commercial morality as recognized here. Perhaps it is this

difference in the point of view that has made our report (as reprinted, not 'abstracted,' in SCIENCE), so unintelligible to Dr. Dall. Another argument for due recognition of the publishing society may be found in such facts as this: A scientific library recently purchased three separate papers, which had been advertised as independent publications and enquired for by readers; all these have since arrived in the regular manner in the report of a society, and the library has as good as thrown away seven shillings through no fault of the librarian. The constant recurrence of this kind of thing renders the authorities very chary of purchasing separately-issued pamphlets, and the workers, few of whom can afford to buy for themselves, have to suffer. Surely any proposal to remedy this should meet with support.

F. A. BATHER.

BRITISH MUSEUM (NAT. HIST.),
January 10, 1899.

NOTES ON INORGANIC CHEMISTRY.

A PAPER was read by Dr. Morris W. Travers before the Royal Society, November 24th, on the origin of the gases evolved in heating mineral substances, meteorites, etc. According to the theory of Professor Tilden these gases are enclosed in minute cavities at high pressure. It is known that some minerals, as quartz, contain liquid hydro-carbons and carbon dioxid, enclosed in cavities, but from a series of exhaustive experiments Dr. Travers concludes that this cannot be the case with the more permanent gases, such as hydrogen, carbon monoxid, nitrogen, helium and argon. He proposes the theory that in the majority of cases where a mineral substance evolves gas under the influence of heat the gas is the product of the decomposition or interaction of its *non-gaseous* constituents at the moment of the experiment. In cleveite and other minerals which contain helium only about one-half this gas is evolved by heat, and hence it would seem that it exists in the form of a compound which is only partially decomposable by heat.

IN a series of analyses of atmospheric air from different sources Armand Gautier, in the *Comptes Rendus*, finds that combustible gases containing carbon are present to a variable degree; on high mountains and over the ocean only traces are found, but a decided quantity in the air of cities. More remarkable, and contrary to previous observers, Gautier finds hydrogen as a constant constituent. The amount he gives is 1.5 volumes in 10,000, or half as great as that of carbon dioxid. Fuller particulars are promised in a later article, which will be looked forward to with no little interest.

THE confusion which attends the use of the sign % for both per cent. of weight and per cent. of volume is patent to all chemists as well as others. At the Congress of Applied Chemistry at Vienna it was proposed by Otto Bleier to confine the use of the sign % to per cent. by weight and to use $^0/_v$ for volume per cent. This was opposed in the discussion by Weinstein. In a recent *Chemiker-Zeitung* Bleier makes a number of proposals, some one of which he hopes will so commend itself to chemists that uniformity may be secured. The proposals, in addition to his original one, are as follows: a. $^0/_g$ or $^0/_p$ (or $^{\cdot}/_g$ or $^{\cdot}/_p$) for weight per cent., and $^0/_v$ (or $^v/.$) for volume per cent.; b. $^g/_0$ or $^p/_0$ (or $^g/.$ or $^p/_0$) for weight percent., and $^v/_0$ (or $^v/.$) for volume per cent.; c. $^g/_g$ or $^p/_p$ for weight per cent., and $^v/_v$ for volume per cent.; d. % for weight per cent., and $^{\cdot}/.$ for volume per cent., or *vice versa*; e. $^0/_g$ or $^0/_p$ for weight per cent., and % for volume per cent. Since the sign % is used so much more frequently to indicate per cent. by weight, it would seem that Bleier's original proposal, which is to confine the use of % to weight and to adopt $^0/_v$ for volume, would be most simple and would speedily reduce the present confusion to a minimum.

THE bacteriological test for the presence of arsenic proposed by Gosio has been further investigated by F. Abba and the results published in the November number of the *Centralblatt für Bakteriologie und Parasitenkunde*. The method consists in growing *Penicillium brevicaule* close to the substance to be examined for arsenic. arsenic is present a strong garlic odor is developed. The method was found to be successful in testing a series of over a hundred dried hides. As regards its delicacy it was found far superior to Marsh's test, as was shown in one

case when a piece of hide one centimeter square gave a distinct test by the bacteriological test, while five times the quantity failed to respond to Marsh's test. It would be interesting to compare this test with that of Reinsch, which has been found by me decidedly sharper and more to be depended on than that of Marsh.

J. L. H.

ZOOLOGICAL NOTES.

Dr. Carlos Berg notes several occurrences of the Antarctic seal, *Lobodon carcinophaga*, well to the northward of its usual habitat, one example having been taken in the La Plata, near Puerto de Ensenada, and another to the northward of Buenos Ayres in lat. 34° 28′ S. This latter was a male captured in June, 1898, and must, from its size, 2.65 meters long, have been an adult animal.

The *Zoological Record*, Vol. 34, containing a list of the zoological papers which appeared in 1897, has just been issued. Amid the rumors of the many good things that the working zoologist is soon to enjoy, it is a great satisfaction to continue to receive this valuable publication of the Zoological Society of London. Surely, 'A bird in the hand is worth two in the bush.'

CURRENT NOTES ON ANTHROPOLOGY.

ANOTHER MEXICAN CODEX.

From a personal letter I learn that Dr. Nicolas Leon, well known for his many contributions to Mexican archæology and history, has discovered a hitherto unknown Mexican Codex in hieroglyphic characters, of which he will soon publish a photo-lithographic reproduction. It dates from the year 1545, and relates to the tributes paid by the town of Tepeai. The proper names of places are written in the usual rebus, or 'ikonomatic' method. They present combinations not found in any of the other known documents of the kind, and some of them are quite puzzling. This discovery will make a welcome addition to the comparatively few specimens of the Mexican graphic method at that date.

THE PROGRESSIVE WOMAN.

A little book, 'Le Feminisme,' published lately in Paris (Colin et Cie, 1898), has some interest to the student of sociology. Its author, Mlle. Kaethe Schirmacher, gives an accurate sketch of the advance of womankind in social position throughout the world of civilization, beginning with the United States and passing to France, Great Britain, Sweden and Russia. Of our own country she says in her preface that she speaks from personal knowledge. We are gratified, therefore, to know that the characteristics of American women are courage (*hardiesse*), the spirit of initiative and capacity for organization. In France 'feminism' has been principally cultivated by the men, not the women; in Sweden very few women are interested in it, though the King favors it; in England it is opposed by the learned institutions, while in Russia they all favor it. On the whole, the outlook for full and equal rights and opportunities for her sex the author considers cheering.

THE SEAT OF THE SOUL.

Understanding by 'soul' the highest intellectual faculties, it is worth considerable trouble to find out where these functions are located. Savages believe that it is in the liver or the heart; cynics suggest that it is in the stomach; phrenologists place them in the front part of the brain; but the most advanced physiologists are now inclined to teach that the posterior cerebral lobes have the highest intellectual value. Dr. C. Clapham's arguments to this effect are quoted with approval in the *Centralblatt für Anthropologie* (1898, Heft 4). These arguments are that man has the most highly developed posterior lobes, and this is conspicuous in men of marked ability and in the highest races. In idiots the lobes are imperfectly developed, and in chronic dementia these portions of the brain reveal frequent lesions. Numerous authorities are quoted in support of these and allied statements.

D. G. Brinton.

University of Pennsylania.

COLLECTIONS OF THE PROVINCIAL MUSEUM OF VICTORIA, BRITISH COLUMBA.

A Preliminary Catalogue of the Collections of Natural History and Ethnology in the Provincial Museum, Victoria, British Columbia, 196

pages, 1898, is now being issued. As it deals only with the British Columbian specimens of the exhibition series, the value of the entire collection is much greater than is suggested by the Catalogue.

The list of mammals includes information as to the source of each specimen and the distribution of the species. The catalogue and index of birds, including 339 species and sub-species, is of all those in British Columbia, while the species not represented in the Museum collection are specially indicated by a check mark. It is this mark which will enable the friends of the institution to devote their energies to securing the desired lacking specimens. Very little is known of the birds of the northeastern part of the province. It thus presents an attractive field for research. There are seven cases of bird groups. The catalogue of the study series of 740 bird skins is not published, but it is available to students. The eggs are listed.

Reptilia, Batrachia, Tunicata, Lepidoptera, Beterocera, Coleoptera, Crustacea, Echinodermata, Mollusca are all catalogued. The lists of fish, trees and plants, algæ and the paleontological specimens are extensive.

The ethnological collection is classified in the list under ceremony, dress, amusement, craniology, houses, monuments, fishing, war, travel, domestic utensils and industries. In the introduction to the list of ethnological specimens the visitor is cautioned against assuming that the Indians of British Columbia resemble the Japanese or were influenced by foreigners prior to European contact. Their difference from the Indians of the Plains is mentioned.

It is gratifying to have accessible so complete a list of the natural history and ethnological specimens of the whole province of British Columbia and to know where most of the specimens listed are available.

HARLAN I. SMITH.

SCIENTIFIC NOTES AND NEWS.

PRESIDENT MCKINLEY has appointed as civilian members of a commission to report on the condition of the Philippine Islands: President Schurman, of Cornell University; Professor Dean C. Worcester, associate professor of zoology in the University of Michigan, and Colonel Denby, for many years United States Minister to China. President Schurman, who is chairman of the commission, has been granted leave of absence until the end of the present year, and Professor T. F. Crane will during the year perform the duties of President.

THE sculptor Herr Ernst Herter has completed the statue of von Helmholtz, which is to be erected in the court of the University of Berlin, between the statues of the two Humboldts. The monument will be unveiled in the spring.

SENATOR PLATT, of Connecticut, has been appointed a Regent of the Smithsonian Institution in the room of the late Senator Morrill, of Vermont.

FATHER RODERIGUES DE PRADA has been made Director of the Observatory of the Vatican.

M. PANAS has been installed as President of the Paris Academy of Medicine, while M. Marey, the physiologist, becomes Vice-President.

THE following officers have been nominated by the French government for its 'Bureau des longitudes:' President, M. Poincaré; Vice-President, M. Faye; Secretary, M. Lippmann.

PROFESSOR A. A. MICHELSON, of the University of Chicago, will give, during March, at Boston, a course of Lowell lectures on 'Light Waves and their Uses.'

Nature states that the recent retirement of Sir John Evans from the Treasurership of the Royal Society, after a period of service of twenty years, has given an opportunity for Fellows of the Society to show their appreciation of the efficient manner in which he discharged the duties of his office. It is proposed to have his portrait painted in oil colors, and to hang it on the walls of the Society's apartments at Burlington House.

THE honors annually conferred on New Year's Day in Great Britain include a K.C.B. on Professor W. C. Roberts-Austin, professor of metallurgy in the Royal College of Science, and a K.C.M.G. on Mr. W. T. Thistleton-Dyer, Director of the Kew Botanic Gardens. Sir Henry Thompson, a surgeon, who has also painted

pictures and written novels, has been given a baronetcy, and Dr. Herman Weber, known for his work on the prevention of consumption, has been knighted. Sir Charles Cameron, Medical Officer of Health of Dublin, has been made C.B.

Professor Henry Alleyne Nicholson, regius professor of natural history at the University of Aberdeen, died on January 19th, aged fifty-four years. He was in 1871 called to the chair of natural history in the University of Toronto, and afterwards to Aberdeen. He was the author of important contributions to paleontology.

Major Jed. Hotchkiss, who in 1895 was Vice-President for Geology of the American Association for the Advancement of Science, and who was the author of contributions to economic geology and engineering, died on January 18th, aged 71 years.

Dr. Wilhelm Dames, professor of geology and paleontology in the University of Berlin, died on December 22d, aged 55 years.

Sir James Mouat, K. C. B., a distinguished army surgeon, formerly Inspector-General of Hospitals in Great Britain, died in London on January 4th, aged 84 years.

The death is announced of Dr. Eugen F. A. Obach, at the age of 46 years. He had made important contributions to electrical engineering and had made a thorough study of the chemistry of gutta percha.

Dr. Giuseppe Bosso, of the Turin University, died on January 17th, from infection contracted while cultivating bacilli in his laboratory.

Drs. Ehlert and Mönnich have lost their lives by an Alpine accident on the Susten Pass. Dr. Ehlert had made valuable contributions to seismology, working at the University of Strasburg. Dr. Mönnich was Assistant to the Bavarian Meteorological Central Station.

The directors of the Benjamin Apthorp Gould fund, which, it will be remembered, Miss Alice Bache Gould gave somewhat more than a year ago to the National Academy of Sciences, announce that they are now prepared to receive applications for appropriations from the income of the fund, which will amount to about $1,000 annually. Preference will be given to investigators working in America or to Americans working abroad, and to work in the astronomy of precision rather than in astrophysics. The directors of the fund, to one of whom applications should be addressed, are Messrs. Lewis Boss, Seth C. Chandler and Asaph Hall.

The Cartwright prize of the Alumni of the College of Physicians and Surgeons, the Medical Department of Columbia University, will be awarded for an essay received not later than April 1st, of the present year. The essay must contain original investigations made by the writer. The value of the prize is $500 and is open to universal competition.

The Swiss Society of Chemical Industry offers a prize of 2,000 fr. for an essay that will promote electro-chemical interests in Switzerland. Essays must be sent by May 1, 1900, to the President of the Society, Mitlodi, Switzerland.

The Washington Botanical Club was organized by a gathering of botanists held at the residence of one of its members November 11, 1898. The limit of membership was fixed at 20, and it was determined that the meetings should be, for the present at least, of a distinctly social and informal nature, with free scope for discussion and the general interchange of ideas. At a subsequent meeting, held December 14th, the organization was perfected by the election of Professor Edward L. Greene as President and Mr. Charles L. Pollard as Secretary. The Club is to hold monthly sessions, devoting itself chiefly to systematic and ecological work, the field of plant physiology and pathology being covered by the already existing Botanical Seminar.

At the annual meeting of the American Geographical Society, on January 16th, Judge Charles P. Daly, whose services to the Society have been so important, was re-elected President. The other officers elected are: Vice-President, the Rev. C. C. Tiffany; Treasurer, Walter T. Jones; Secretary, Chandler Roberts; Councilors, Rear-Admiral Bancroft Gherardi, William Hamilton, Henry Holt, Clarence King and Charles A. Peabody.

At the annual meeting of the Philadelphia

Academy of Natural Sciences the following officers, Councillors and members of the Finance Committee, to serve during 1899, were elected:

President, Samuel G. Dixon, M.D.; Vice Presidents, Thomas Meehan, Rev. Henry C. McCook, D.D.; Recording Secretary, Edward J. Nolan, M.D.; Corresponding Secretary, Benjamin Sharp, M.D.; Treasurer, George Vaux, Jr.; Librarian, Edward J. Nolan, M.D.; Curators, Henry A. Pilsbry, Henry C. Chapman, M.D., Arthur Erwin Brown, Samuel G. Dixon, M.D.; Councillors to serve three years, Charles E. Smith, Uselma C. Smith, John Cadwalder, William Sellers; Finance Committee, Charles Morris, Chas. E. Smith, Uselma C. Smith, William Sellers, Charles Roberts; Councillor for unexpired term of two years, Charles Schaffer, M.D.

The following standing committees were appointed for the year:

Publications: Thomas Meehan, Charles E. Smith, Henry A. Pilsbry, Henry Skinner, M. D., Edward J. Nolan, M. D.

Library: Arthur Erwin Brown, Thomas A. Robinson, Henry C. Chapman, M. D., Dr. C. Newlin Peirce and Charles Schaffer, M. D.

Instruction and Lectures: Uselma C. Smith, Benj. Smith Lymann, Samuel G. Dixon, M. D., Philip P. Calvert and Charles Morris.

Committee of Council on By-Laws: Isaac J. Wistar, Theodore D. Rand, Arthur Erwin Brown and Benjamin Sharp, M. D.

THE Ninth International Congress of Ophthalmology will be held at Utrecht from August 14 to 18, 1899. The scientific work of the Congress will be divided among three sections, as follows: (1) Anatomy, Pathological Anatomy and Bacteriology; (2) Optics and Physiology; (3) Clinical and Operative Methods.

THE annual meeting of the Board of Managers of the New York Zoological Society was held on January 17th, with the Hon. Levi P. Morton, the President of the Society, in the chair. The Chairman of the Executive Committee, Professor Henry F. Osborn, reported the important progress in the construction of buildings and other installations, to which we recently called attention. It was announced at the meeting that Mr. Cornelius Vanderbilt had contributed $5,000 toward the building fund.

THE Finance Committee of the Philadelphia City Council has reported favorably upon a proposed loan of $200,000 by the city for the buildings and equipments of the Philadelphia Museums. The bill will probably be passed by the Council, and this insures the raising of the $300,000 required under the Act of Congress appropriating $300,000 towards the aid of the exposition of manufactured products of the United States to be held in Philadelphia next autumn. $50,000 has been appropriated by the State Legislature and $50,000 has been collected by private subscription. The United States government has also appropriated a further sum of $50,000 for the purchase of samples of foreign goods to show the kind of goods that should be exported. Dr. W. P. Wilson, Director of the Museums, will be Director-General of the Exposition.

A CHEMICAL and pharmaceutical laboratory has been opened in Rajkote, in western India. 30,000 rupees have been given for the construction of the building by Azam Laxmon Meran. The equipment is paid for by the state. Mr. H. L. Lee has been appointed director of the laboratory.

M. EMILE DUBOIS has introduced into the French Chamber of Deputies a bill providing for the creation in each department of France of one or more bacteriological laboratories, with a view to the repression and prevention of contagious diseases, particularly tuberculosis.

E. C. SIMMONS, ex-Mayor of Kenosha, Wis., has offered to build and present to that city a library building and to purchase 25,000 volumes for it. The estimated cost of the gift is $100,000.

THE Amesbury (Mass.) public library will receive $10,000 by the will of the late Mary A. Barnard.

THE corner stone of the School of Practical Horticulture was laid at Hyeres on January 8th, in the presence of M. Viger, the French Minister of Agriculture.

THE Field Columbian Museum, Chicago, has secured, through the generosity of Mr. Stanley R. McCormick, a valuable collection of articles from the Moqui tribes of the Pueblo Indians. It was made by a missionary and represents the arts of the tribes from their earliest association with the pioneers up to the present time.

A TELEGRAM from Sydney has been received

at the Royal Society stating that the boring into the coral atoll of Funafuti had been discontinued on reaching a depth of 1,114 feet. Cores had been obtained, and the material traversed is described as 'coral reef' rock.

THE English papers state that arrangements are being made, under the direction of Signor Marconi, at the South Foreland lighthouse and on board the South Goodwin lightship for a series of experiments in wireless telegraphy. If the experiments are considered satisfactory, it is stated that the wireless system will be adopted forthwith as a means of communication between the South Foreland lighthouse and the South Sands Head lightship. The points of communication are about three miles apart.

THE *British Medical Journal* reports that M. Cruppi recently laid before the French Chamber of Deputies a bill for reforming medical expert evidence. M. Cruppi proposes that a list of medical experts should be drawn up every year. None but men of undoubted scientific ability should be on the list; the accused person should have the right to name his or her own expert, who should work in cooperation with the expert named by the Judge. In cases where the two experts do not agree the matter should be decided by a committee composed of eminent scientific men. The Commission of Judicial Reform is considering the question.

MEN of science will not be surprised to learn that an examination of the late John W. Keeley's exhibition room has brought to light tubes and other arrangements by which compressed air could have been used to run his motor. Wheels went round without doing any work and could have been readily turned by compressed air or in other ways, in the exhibition made some years ago to the present writer. It was at the time indicated that he would be given $5,000 if he would state over his signature that the operations could not be accounted for by known natural forces.

IT is stated in the daily papers that Mr. Elmer Gates, Washington, wishes to form a commercial company to obtain money to enable him to proceed with the invention of his microscope, which he is said to say magnifies 3,000,000 diameters.

UNIVERSITY AND EDUCATIONAL NEWS.

WE regret to learn that the California Courts have decided that the trust clause in the will of the late Adolph Sutro, giving Sutro Heights as a public park to the city of San Francisco, and San Miguel Ranch to support a scientific school, is invalid, and the property will now go into the residuary estate and be divided among six children. Perhaps these children will set the Courts an example by fulfilling the wishes of their father.

THE late Miss Rebecca Flower Squiers, of London, has bequeathed £2,000 for scholarships for students at Oxford or Cambridge, and the residue of her estate, the amount of which is not stated, for the benefit of these universities.

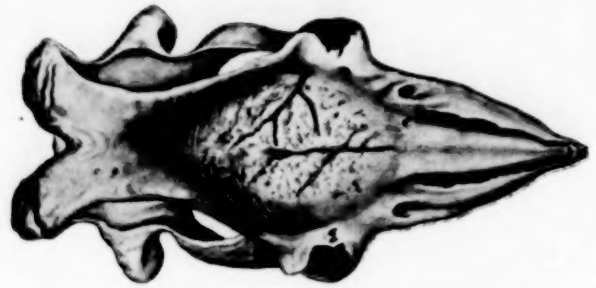
PROFESSOR CLEVELAND ABBE has given to the Johns Hopkins University his valuable collection of books, journals and pamphlets relating to meteorology. The library has also received an anonymous gift of $5,000 for the purchase of books.

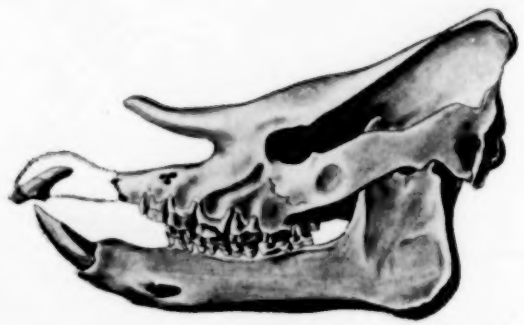
REV. DR. GEORGE E. MERRILL, of Newton, Mass., has accepted the call to the presidency of Colgate University, Hamilton, N. Y.

PROFESSOR J. B. JOHNSON, who holds the the chair of engineering in Washington University, St. Louis, has been called to the University of Wisconsin, where he will be made Dean of the College of Engineering.

MR. G. F. STOUT, Anderson lecturer on comparative psychology at Aberdeen and formerly lecturer on psychology at Cambridge, has been appointed to the newly established Wilde lectureship of mental philosophy at Oxford.

THE professorship of physics in the University of Sydney, New South Wales, is vacant. In accordance with the British custom, applications for the position, with eight copies of all testimonials, must be received not later than February 18th by Sir Daniel Cooper, acting agent-general for New South Wales, 9 Victoria St., London, S. W. The salary of the professorship is £900 per annum, with a conditional pension of £400. Candidates must be under 35 years of age. We presume that citizens of the United States are eligible.





OSBORN on *Aceratherium incisivum.*